

## **APPENDIX G**

### **DETAILED DESCRIPTIONS OF THE NVCS VEGETATION ASSOCIATIONS AT FLFO**

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## I. FOREST

### I.A.8.N.c. Conical-crowned temperate or subpolar needle-leaved evergreen forest

#### I.A.8.N.c.30. PICEA PUNGENS FOREST ALLIANCE

##### Blue Spruce Forest Alliance

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##### PICEA PUNGENS / JUNIPERUS COMMUNIS FOREST

##### Blue Spruce / Common Juniper Forest

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** These forests occur at middle elevations (1800-3300 m) of the central and southern Rocky Mountains, usually in moist, concave topographic positions. These communities often occupy sites that are protected from extreme sun and wind, within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. These forests are typically most common on north-facing slopes, which can be gentle to steep. These forests are characterized by the dominance of *Picea pungens* in the forest canopy and usually represent a mesic phase of the mixed conifer forests of the southern Rocky Mountains and Colorado Plateau. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Pseudotsuga menziesii*, *Abies lasiocarpa*, and *Pinus ponderosa*. *Populus tremuloides* is the only widespread hardwood associate. The shrub layer is usually of only moderate cover and dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common species include *Arctostaphylos uva-ursi*, *Juniperus communis*, *Mahonia repens*, and *Rubus parviflorus*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids, including *Packera cardamine* (= *Senecio cardamine*), *Fragaria virginiana*, *Linnaea borealis*, *Pseudoroegneria spicata*, *Erigeron eximius*, *Thalictrum fendleri*, *Maianthemum stellatum*, and *Achillea millefolium*. Adjacent vegetation is usually *Pinus ponderosa* - *Pseudotsuga menziesii* forests at the upslope margin and herbaceous or woody riparian communities where this vegetation grades into streamside wetlands. This association is closely aligned with *Picea pungens* / *Arctostaphylos urva-ursi* Forest [CEGL000385] and *Picea pungens* / *Mahonia repens* Forest [CEGL000395]. The presence and abundance of *Arctostaphylos urva-ursi* keys to the former, while a lack of *Juniperus communis* and presence of *Mahonia repens* keys to the later.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** These forest stands occupy moderate to steep drainages, toeslopes, and midslopes (11–43%) throughout the monument. The slope exposures are generally northeast through northwest (5°–312°), however, some exposures that range into the southeast and southwest are possible because of drainage orientation. Stands receive the maximum amount of snow accumulation in winter, due to the location, stand height, and stand density, however, drainage from these stands is rapid during snowmelt or rainfall events. Although rapid drainage occurs because of the steep slopes, the forest floor is covered by thick leaf and woody litter, and moisture retention within the stand was considered to be high.

**Global Environment:** These forests occur at middle elevations (1800-3300 m) of the central and southern Rocky Mountains, usually in moist, concave topographic positions. Precipitation averages 46-60 cm annually, with the majority falling as growing season rainfall. The temperature regime is continental and winters are moderately severe. Soils are variable, but usually young and derived from glacial or alluvially deposited materials. The pH is neutral to slightly alkaline. Youngblood and Mauk (1985) suggest a preference by these forests for non-igneous parent materials. These communities often occupy sites that are protected from extreme sun and wind, within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. These forests are typically most common on north-facing slopes, which can be gentle to steep. Adjacent vegetation is usually *Pinus ponderosa* - *Pseudotsuga menziesii* forests at the upslope margin and herbaceous or woody riparian communities where this vegetation grades into streamside wetlands.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Stands are uniformly tall (30-35 m) and dense (60–65% or greater foliar cover), characterized by canopies of *Picea pungens*, *Pseudotsuga menziesii*, *Pinus ponderosa*, and *Populus tremuloides* trees. *Picea pungens* usually provides nearly all of the canopy cover present with only minor contributions from the other tree species. The forest subcanopy consists of the same tree species as above, and occasionally *Pinus flexilis*. Subcanopy trees are typically 15–20 m tall and provide approximately 15–20% foliar cover. Trunk diameters were very consistent between species on an average, e.g., *Picea pungens* = 22 cm dbh, *Pseudotsuga menziesii* = 24 cm dbh, and *Populus tremuloides* = 21 cm dbh. The largest trunk diameters recorded in

sampld stands were *Picea pungens* = 36.3 cm, *Pseudotsuga menziesii* = 40.3 cm, *Pinus flexilis* = 28.0 cm, and *Populus tremuloides* = 29.5 cm. The shrub layers support seedlings and saplings of the dominant tree species in addition to *Juniperus communis*, *Dasiphora fruticosa*, *Ribes cereum*, *Arctostaphylos uva-ursi*, and *Rosa woodsii*, among others. Tall shrubs are 2–4 m in height and provide less than 10% foliar cover. Short shrubs are 0.5–2 m tall and provide less than 5% foliar cover, an exception occurring at one sample site where *Juniperus communis* provided approximately 20% foliar cover. Graminoids and forbs contribute little (less than 5%) to the foliar cover values because of the dense shading on the ground surface and the presence of thick litter and downed wood. The most common graminoids present where minor canopy openings allow light penetration include *Danthonia parryi*, *Festuca arizonica*, and species of *Carex*. The forbs are characterized by *Fragaria virginiana* and *Fragaria vesca*, *Thalictrum fendleri*, *Maianthemum stellatum*, and *Solidago* sp. Ground cover was typically divided between litter and downed wood. Some sites visited contained 100% cover by litter, and others were nearly evenly divided (50% each) between herbaceous and woody litter on the ground surface. Both moss and lichen species were present (up to 15% cover in some stands), and foliose lichens were common on tree trunks and branches.

This forest type provides a very dark aerial photo signature, consistent on both true color and CIR photos. Stands typically exceed the minimum mapping unit, but confusion could result with interpretation of this type from forests dominated by *Pseudotsuga menziesii*.

**Global Vegetation:** These forests are characterized by the dominance of *Picea pungens* in the forest canopy and usually represent a mesic phase of the mixed conifer forests of the southern Rocky Mountains and Colorado Plateau. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Pseudotsuga menziesii*, *Abies lasiocarpa*, and *Pinus ponderosa*. *Populus tremuloides* is the only widespread hardwood associate. The shrub layer is usually of only moderate cover and dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common species include *Quercus gambelii*, *Amelanchier alnifolia*, *Acer glabrum*, *Arctostaphylos uva-ursi*, *Juniperus communis*, *Mahonia repens*, and *Rubus parviflorus*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids, including *Carex siccata* (= *Carex foenea*), *Festuca arizonica*, *Arnica cordifolia*, *Packera cardamine* (= *Senecio cardamine*), *Fragaria virginiana*, *Linnaea borealis*, *Pseudoroegneria spicata*, *Erigeron eximius*, and *Achillea millefolium*. This association is closely aligned with *Picea pungens* / *Arctostaphylos urva-ursi* Forest [CEGL000385] and *Picea pungens* / *Mahonia repens* Forest [CEGL000395]. The presence and abundance of *Arctostaphylos urva-ursi* keys to the former, while a lack of *Juniperus communis* and presence of *Mahonia repens* keys to the later.

#### Global Dynamics:

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Pseudotsuga menziesii</i> , <i>Pinus ponderosa</i> , <i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i>
Graminoid	<i>Danthonia parryi</i>
Forb	<i>Thalictrum fendleri</i> , <i>Fragaria virginiana</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Pseudotsuga menziesii</i>
Shrub	<i>Juniperus communis</i> , <i>Arctostaphylos uva-ursi</i>
Graminoid	<i>Carex siccata</i> , <i>Festuca arizonica</i>
Forb	<i>Arnica cordifolia</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Pseudotsuga menziesii</i> , <i>Pinus ponderosa</i> , <i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i>
Graminoid	<i>Danthonia parryi</i>
Forb	<i>Thalictrum fendleri</i> , <i>Fragaria virginiana</i> , <i>Maianthemum stellatum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i>
Shrub	<i>Juniperus communis</i>

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## OTHER NOTEWORTHY SPECIES

### Florissant Fossil Beds NM

#### Global Stratum

#### Species

#### GLOBAL SIMILAR ASSOCIATIONS:

- *Picea pungens* / *Arctostaphylos urva-ursi* Forest (CEGL000385) Note: Juncom is present in most stands, but has less than 5% cover, while Aruv averages >20%
- *Picea pungens* / *Mahonia repens* Forest (CEGL000395) Note: Aruv and Juncom are generally not present in this type.

#### SYNONYMY:

- DRISCOLL FORMATION CODE:I.A.9.c. (Driscoll et al. 1984) B
- *Picea pungens*/*Juniperus communis* (Bourgeron and Engelking 1994) =

## GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G4G5.

**Global Classification Comments:**

## ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** This forest type was observed on the toeslope of north-facing ridges, hills, and drainage sides and was recorded from approximately 8280-8880 feet in elevation within the monument. In the higher elevations of the southeastern portion of the monument, this type also occupies perennial and intermittent drainages in the headwaters of Grape Creek.

**Global Range:** This association is known from the Colorado Plateau and southern Rocky Mountains in Utah and Colorado, and may occur in Arizona.

**Nations:** US

**States/Provinces:** AZ? UT CO

## ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 19, 89

**Classification Confidence:** 2 **Identifier:** CEGL000392

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Kerr and Henderson 1979, Roberts et al. 1992, Youngblood and Mauk 1985.

#### Note:

This association is found in two different map classes:

- 1) Colorado Blue Spruce - Douglas-fir Forest
- 2) Colorado Blue Spruce - Douglas-fir - Quaking Aspen Forest

## I.A.8.N.c.22. PSEUDOTSUGA MENZIESII FOREST ALLIANCE

Douglas-fir Forest Alliance

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### PSEUDOTSUGA MENZIESII / JUNIPERUS COMMUNIS FOREST

Douglas-fir / Common Juniper Forest

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## ELEMENT CONCEPT

**GLOBAL SUMMARY:** This forest association occurs in central and eastern Idaho, southwestern Montana, western Wyoming and north-central Colorado. These forests occupy moderate to steep slopes (11–51%), on exposed rocky slopes and ridgetops, at lower to mid elevations of the forested zone, from 6500-9300 elevation. *Pseudotsuga menziesii* is the dominant tree species in the overstory and often in the understory as well. *Pinus flexilis*, *Pinus contorta*, or *Pinus albicaulis* are occasionally present on drier sites, *Populus tremuloides* on moister sites. The low-shrub layer is dominated by near-continuous to large patches of *Juniperus communis*. Other shrubs include *Symphoricarpos oreophilus*, *Shepherdia canadensis*, *Mahonia repens*, *Ribes* spp., and *Juniperus horizontalis*. The

herbaceous cover is generally depauperate, with less than 10% cover of grasses or forbs. Forb species typically provide less than 5% cover and include *Arnica cordifolia*, *Astragalus miser*, *Packera streptanthifolia* (= *Senecio streptanthifolius*), and *Achillea millefolium* var. *occidentalis* (= *Achillea lanulosa*). Grass species also contribute less than 5% herb canopy cover and include *Muhlenbergia montana*, *Danthonia parryi*, *Bouteloua gracilis*, or *Festuca arizonica*.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** These forests occupy moderate to steep slopes (11–51%), merging into *Pinus ponderosa* / *Festuca arizonica* Woodland (CEGL000856) on upper stand margins and *Picea pungens* / *Juniperus communis* Forest (CEGL000392) on lower stand margins. Very little soil is exposed in this type and consists of gravel eroded from Pikes Peak granite bedrock. A few granite boulders are exposed; however, they are largely encrusted or covered with lichens and mosses. Stands of Douglas-fir / Common Juniper Forest typically occupy the entire slope, from the upper toeslope to the ridge or hill shoulder. *Pseudotsuga menziesii* / *Juniperus communis* Woodland (CEGL000439) stands are uncommon within the monument and are related to logging and/or fire opening the tree canopy through removal of individual Douglas-fir trees. The upper slope topographic position represents a drier habitat, thus contributing to the sparse foliar cover for trees in the stand. It is unlikely that these stands are large enough to meet the minimum mapping unit for the project. Some woodland sites contained large Pikes Peak granite boulders and quantities of downed wood (15–30%).

**Global Environment:** These forests occupy moderate to steep slopes (11–51%), on exposed rocky slopes and ridgetops, at lower to mid elevations of the forested zone, from 6500–9300 elevation. Bare rock can be as much as 40% , often encrusted with lichens; litter depth is usually less than 6 cm.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This forest type is relatively uniform in canopy height, from 20–25 m tall, with only occasional emergent trees. Foliar cover of the canopy layer ranges from 60–75% with approximately 35–65% of the cover value contributed by *Pseudotsuga menziesii*. Other tree species observed in the canopy layer included *Picea pungens* and *Populus tremuloides*. Trunk diameters for *Pseudotsuga menziesii* averaged 25 cm dbh (the largest recorded was 54 cm), for *Picea pungens* 26 cm dbh (the largest recorded was 42 cm), for *Populus tremuloides* 17 cm dbh (the largest recorded was 20 cm), and one *Pinus ponderosa* (14 cm dbh) were present in sampled plots. A tree understory or subcanopy, including the tall-shrub layer, is almost always present and is composed of sapling *Pseudotsuga menziesii*, *Picea pungens*, *Pinus ponderosa*, and *Populus tremuloides*. The subcanopy accounts for approximately 5% foliar cover within a stand. Common shrubs within stands are typically from 0.5–1.0 m tall and include *Juniperus communis*, *Arctostaphylos uva-ursi*, *Ribes cereum*, and *Rosa woodsii*. Short shrubs contribute approximately 5–20% to the stand foliar cover, with *Juniperus communis* the most common short shrub present. Graminoids are under 0.5 m in height, provide less than 5% foliar cover, and are dominated by *Danthonia parryi*, *Muhlenbergia montana*, and *Bouteloua gracilis*. Forbs are also under 0.5 m tall and provide less than 5% foliar cover for a stand. The more common forb species identified include *Thalictrum fendleri*, *Maianthemum stellatum*, *Oxytropis lambertii*, and *Solidago* sp. Ground cover was typically 60–80% herbaceous litter and from 15–40% downed wood. One mesic stand had developed a layer of moss and lichen that covered approximately 35% of the ground surface.

A few drier sites supported small stands of *Pseudotsuga menziesii* / *Juniperus communis* Woodland (CEGL000439), which were included in this description, in the following paragraph. *Pseudotsuga menziesii* / *Juniperus communis* Woodland (CEGL000439) stands are uncommon, because most sites supporting Douglas-fir are more mesic and are placed in a forest category (greater than 60% foliar cover by tree species). Douglas-fir, to approximately 20 m tall, provide approximately 25–30% foliar cover within woodland stands. Associated canopy trees are typically *Pinus ponderosa*, *Pinus flexilis*, and *Populus tremuloides*; however, only *Pinus ponderosa* contributed significantly to foliar cover (approximately 5–15%). Douglas-fir within the woodland stands sampled averaged 21 cm dbh, ponderosa pine averaged 30 cm dbh, and quaking aspen averaged 15 cm dbh. The largest tree was a ponderosa pine (43 cm dbh) and large, cut stumps of both Douglas-fir and ponderosa pine were present from historic logging activity. The tall shrubs (from 2–3 m) within the woodland stands were sapling Douglas-fir and ponderosa pine and contributed less than 5% foliar cover. *Juniperus communis* is the dominant short shrub (0.5–1.0 m tall), providing foliar cover of approximately 10% in one stand and up to 40% in another. The persistence of *Juniperus communis* in the understory suggests the former site condition of a forest canopy prior to logging activity. Other shrubs present in the understory, but contributing less than 5% foliar cover, include *Arctostaphylos uva-ursi* and *Ribes cereum*. Graminoids are also sparse providing from 5–10% foliar cover and included *Muhlenbergia montana*, *Danthonia parryi*, and *Festuca arizonica*. Forbs provide from 2–3% foliar cover and were represented by *Geranium caespitosum*, *Hymenoxys richardsonii*, and *Antennaria* sp. Ground cover ranged from 50–95% herbaceous litter and up to 30% woody litter. Large cut stumps of Douglas-fir and ponderosa pine were common, and exposed gravel accounted for approximately 15% ground cover at two sample sites.



Stands of this forest will be difficult to interpret from stands of *Picea pungens* / *Juniperus communis* Forest (CEGL000392) growing on slopes above drainages. In many cases there is almost an even mix of the two species within a stand, in terms of canopy height, tree density, and dbh. Aerial photo signatures are dark green for both associations on true color, and similar signatures appear on CIR. Aerial photo signatures are similar between the forest and woodland types, particularly when slope exposure and position on the slope is considered.

**Global Vegetation:** *Pseudotsuga menziesii* is the dominant tree species in the overstory and often in the understory as well. *Pinus flexilis*, *Pinus contorta*, or *Pinus albicaulis* are occasionally present on drier sites, *Populus tremuloides* on moister sites. The low-shrub layer is dominated by near-continuous to large patches of *Juniperus communis*. Other shrubs include *Symphoricarpos oreophilus*, *Shepherdia canadensis*, *Mahonia repens*, *Ribes* spp., and *Juniperus horizontalis*. The herbaceous cover is generally depauperate, with less than 10% cover of grasses or forbs. Forb species typically provide less than 5% cover and include *Arnica cordifolia*, *Astragalus miser*, *Packera streptanthifolia* (= *Senecio streptanthifolius*), *Achillea millefolium* var. *occidentalis* (= *Achillea lanulosa*), *Galium boreale* (= *Galium septentrionale*), *Geranium caespitosum*, *Hymenoxys richardsonii*, *Antennaria* spp., *Thalictrum fendleri*, *Maianthemum stellatum*, *Oxytropis lambertii*, or *Solidago* sp. Grass species also contribute less than 5% herb canopy cover and include *Muhlenbergia montana*, *Danthonia parryi*, *Bouteloua gracilis*, or *Festuca arizonica*.

**Global Dynamics:** *Juniperus communis* is easily eliminated by fire (Steele et al. 1981).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pseudotsuga menziesii</i> , <i>Picea pungens</i> , <i>Pinus ponderosa</i>
Shrub	<i>Juniperus communis</i> , <i>Arctostaphylos uva-ursi</i>
Graminoid	<i>Danthonia parryi</i> , <i>Muhlenbergia montana</i>
Forb	<i>Thalictrum fendleri</i> , <i>Maianthemum stellatum</i> , Goldenrod ( <i>Solidago</i> sp.), <i>Geranium caespitosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pseudotsuga menziesii</i>
Shrub	<i>Juniperus communis</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pseudotsuga menziesii</i> , <i>Picea pungens</i> , <i>Pinus ponderosa</i>
Shrub	<i>Juniperus communis</i> , <i>Ribes cereum</i> , <i>Arctostaphylos uva-ursi</i>
Graminoid	<i>Danthonia parryi</i> , <i>Muhlenbergia montana</i>
Forb	<i>Thalictrum fendleri</i> , <i>Maianthemum stellatum</i> , <i>Solidago</i> sp., <i>Fragaria virginiana</i> , <i>Geranium caespitosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pseudotsuga menziesii</i>
Shrub	<i>Juniperus communis</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

##### SYNONYMY:

- DRISCOLL FORMATION CODE:I.A.9.c. (Driscoll et al. 1984) B
- *Pseudotsuga menziesii*/*Juniperus communis* (Bourgeron and Engelking 1994) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G4.

**Global Classification Comments:**

### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Pseudotsuga menziesii* / *Juniperus communis* Forest occurs on north- and west-facing slopes (256°–358°), in drainages, along ridges, and other mesic sites within the monument. Most stands occur at mid to high elevations (8525–8875 feet were recorded). Open, woodland stands occur sporadically within the monument, possibly due to historic logging activity coupled with relatively dry site conditions, resulting in a more open canopy. All sampled woodland sites were located on moderately steep (10–24%) upper slopes and aspects from 10°–256°.

**Global Range:** This forested association occurs in central and eastern Idaho, southwestern Montana, western Wyoming and north-central Colorado.

**Nations:** US

**States/Provinces:** CO ID MT WY

### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 30, 55, 56, 76, 81, 83, 87

**Classification Confidence:** 1 **Identifier:** CEG000439

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Giese 1975, Johnston 1987, Murphy 1982, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Vories 1974.

#### Note:

This association is found in two different map classes:

- 1) Colorado Blue Spruce - Douglas-fir Forest
- 2) Colorado Blue Spruce - Douglas-fir - Quaking Aspen Forest

## I.B.2.N.b. Montane or boreal cold-deciduous forest

### I.B.2.N.b.10. POPULUS TREMULOIDES FOREST ALLIANCE

#### Quaking Aspen Forest Alliance

#### ALLIANCE CONCEPT

**Summary:** Forests in this alliance are found on rolling topography such as the glacial moraines in Minnesota or the Turtle Mountains and Pembina Hills of North Dakota, often occurring between grasslands and other forest types. The soils are usually deep, well-developed, and loamy. Stands in this alliance often originate following disturbance. This alliance is widespread in the western United States, the northern Great Plains, and extends into the western Great Lakes area. The dominant species of the canopy is *Populus tremuloides*. In the midwestern United States, *Quercus macrocarpa* and *Betula papyrifera* are common associates and can even be codominant in some stands. The shrub layer can be made up of several shrubs common to the Great Plains, including *Corylus cornuta*, *Corylus americana*, *Prunus virginiana*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, and *Rubus* spp. In wetter stands *Cornus* spp. and *Salix* spp. may also be present. The herbaceous layer may contain *Aralia nudicaulis*, *Carex pensylvanica*, *Maianthemum canadense*, *Maianthemum stellatum*, *Viola* spp., and *Thalictrum dioicum*. In the western United States common associates include *Acer glabrum*, *Amelanchier alnifolia*, *Symphoricarpos oreophilus*, *Bromus carinatus*, *Calamagrostis rubescens*, *Thalictrum fendleri*, *Carex siccata* (= *Carex foenea*), *Carex geyeri*, *Carex rossii*, and *Hesperostipa comata* (= *Stipa comata*). In the Dakotas and Wyoming, these stands may remain successional stable for many dozens of years, while in the more mesic, eastern portion of the range, *Populus tremuloides* forests succeed to other community types much more quickly. *Populus tremuloides* (the species) reaches Texas, Virginia, and West Virginia, but it is unclear whether *Populus tremuloides* communities occur in any of these states. Stands of *Populus tremuloides* in the Trans-Pecos of western Texas occur in ravines and on open talus slopes above 2134 m (7000 feet) elevation; they may best be treated as *Populus tremuloides* communities, or merely as other communities with a component of aspen. Texas stands of *Populus tremuloides* are of limited extent and variable in structure.

**Environment:** Forests included in this alliance occur extensively in the western U.S., northern Great Plains and extend into the western Great Lakes area. Elevations range from 900–3350 m. Climate is temperate with a relatively long growing season, typically cold winters and often deep snow. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm, except in semi-arid environments where stands are restricted to mesic microsites such as seeps or large snow drifts. Distribution of these forests is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondarily, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). Topography is variable, sites range from level to steep slopes. Aspect varies according to the limiting factors. Stands at high elevations or northern latitudes are restricted by cold temperatures and are found on warmer southern aspects. At lower elevations or southern latitudes stands are restricted by lack of

moisture and are found on cooler north aspects and mesic microsites. The soils are typically deep and well-developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loams. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but it appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Geography strongly influences this type. In the western U.S., stands occur on mesic upland sites and stream terraces above the floodplain. In the Rocky Mountains, a band of this type occurs at the lower treeline from the plains to toe slopes and slumps. In the Great Basin and southwestern U. S. and the annual precipitation is typically low and stands are found in areas where subsurface soil moisture accumulates or where temperature and evaporation rates are lower such as in swales and canyons, below seeps, and on north aspects of slopes at higher elevations. Stands of *Populus tremuloides* in the Trans-Pecos of western Texas occur in ravines and on open talus slopes above 2135 m. In the northern Great Plains, these forests are typically found on rolling topography such as the glacial moraines in Minnesota or the Turtle Mountains and Pembina Hills of North Dakota (Potter and Moir 1961, MNNHP 1993). They are often on the prairie-forest border between grasslands and other forest types from northern Minnesota to Iowa (Hoffman and Alexander 1987, MNNHP 1993).

**Vegetation:** Vegetation included in this widespread forest alliance occurs in the western U.S., northern Great Plains and extends into the western Great Lakes area. Stands have a somewhat closed to closed canopy of trees to 5-20 m tall, that is dominated or codominated by the cold-deciduous broad-leaved tree *Populus tremuloides*. Other broad-leaved trees such as *Populus balsamifera* ssp. *trichocarpa*, *Quercus macrocarpa*, and *Betula papyrifera* may be present to codominant depending on geography and topography. Several species of conifer trees may also be present in the tree canopy. Conifers include *Abies concolor*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea pungens*, *Pinus contorta*, *Pinus ponderosa*, and *Pseudotsuga menziesii*. Conifer species may contribute up to 25% of the tree canopy before the stand is reclassified as a mixed stand. Because of the open growth form of *Populus tremuloides* enough light can penetrate for lush understory development. Depending on available soil moisture and other factors like disturbance, the understory structure may be complex with multiple shrub and herbaceous layers, or simple with just a herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs.

In the western U.S. common tree associates include *Populus balsamifera* ssp. *trichocarpa* in the northern Rocky Mountains (Cooper and Heidel 1997). Scattered conifer trees such as *Pseudotsuga menziesii* and species of *Pinus*, *Picea*, *Abies* may also be present. Common shrubs include *Acer glabrum*, *Amelanchier alnifolia*, *Artemisia tridentata*, *Juniperus communis*, *Prunus virginiana*, *Rosa woodsii*, *Shepherdia canadensis*, *Symphoricarpos oreophilus* and the dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus*. The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus*, *Calamagrostis rubescens*, *Carex siccata* (= *Carex foenea*), *Carex geyeri*, *Carex rossii*, *Elymus glaucus*, *Elymus trachycaulus*, *Festuca thurberi*, and *Hesperostipa comata* (= *Stipa comata*). Associated forbs may include *Achillea millefolium*, *Eucephalus engelmannii* (= *Aster engelmannii*), *Delphinium X occidentale*, *Geranium viscosissimum*, *Heracleum sphondylium*, *Ligusticum filicinum*, *Lupinus argenteus*, *Osmorhiza berteroi* (= *Osmorhiza chilensis*), *Pteridium aquilinum*, *Rudbeckia occidentalis*, *Thalictrum fendleri*, *Valeriana occidentalis*, *Wyethia amplexicaulis* and many others. Exotic grasses such as the perennial *Poa pratensis* and the annual *Bromus tectorum* are often common in stands disturbed by grazing.

In the midwestern United States, these forests are found along the prairie-forest border from northern Minnesota to Iowa. *Quercus macrocarpa* and *Betula papyrifera* are common associates and are codominant in some stands. Scattered *Fraxinus pennsylvanica*, *Populus balsamifera*, *Quercus ellipsoidalis*, *Tilia americana*, and *Ulmus americana* may also be present. The shrub layer can be made up of several shrubs common to the Great Plains, including *Corylus cornuta*, *Corylus americana*, *Prunus virginiana*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, *Viburnum opulus* var. *americanum* (= *Viburnum trilobum*), and *Rubus* spp. In wetter stands *Cornus* spp. and *Salix* spp. may also be present. The herbaceous layer may contain *Aralia nudicaulis*, *Carex pensylvanica*, *Maianthemum canadense*, *Maianthemum stellatum*, *Sanicula marilandica*, *Oryzopsis asperifolia*, *Schizachne purpurascens*, *Viola* spp., and *Thalictrum dioicum*.

*Populus tremuloides* (the species) reaches Texas, Virginia, and West Virginia, but it is unclear whether *Populus tremuloides* communities occur in any of these states. Texas stands of *Populus tremuloides* are of limited extent and variable in structure. More study is needed to determine this.

**Dynamics:** Stands in this alliance often originate, and are likely maintained, by stand-replacing disturbances such as crown fire, disease and windthrow, or clear-cutting by man or beaver. The stems of these thin-barked, clonal trees are easily killed by ground fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1993). The stems are relatively short-lived (100-150 years), and the stand will succeed to longer-lived conifer forest if undisturbed. Stands are favored by fire in the conifer zone (Mueggler 1988). With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because of the long moist conditions required to establish are rare in the extant habitats. Superficial soil drying will kill seedlings (Knight 1994). In the Dakotas and Wyoming, these stands may remain

successionally stable for many dozens of years (Girard et al. 1989). In the more mesic areas of the eastern segment of its range, they succeed to other community types much more quickly (MNNHP 1993).

**Comments:** This alliance is floristically similar to other forest alliances that are dominated by *Populus tremuloides* alone or in combination with *Betula papyrifera*. Among these are I.B.2.N.e *Populus tremuloides* - *Betula papyrifera* Forest Alliance (A.269), I.B.2.N.d *Populus tremuloides* Temporarily Flooded Forest Alliance (A.300), and I.C.3.N.a *Picea glauca* - *Abies balsamea* - *Populus* spp. Forest Alliance (A.418). Stands in Texas may best be treated as *Populus tremuloides* communities or merely as other communities with a component of aspen. Texas stands of *Populus tremuloides* are of limited extent and variable in structure. Further information is needed. Stands in Nevada, described by Blackburn et al. (1968a, 1968b, 1971), are restricted to stream terraces, do not have enough tree canopy cover to be classified as forests, and would be better classified as woodlands. More study is needed especially if these sites have a flood regime. Stands in California need association-level description.

#### ALLIANCE DISTRIBUTION

**Range:** Forests included in the alliance have been described from across the western United States, northern Great Plains, extend into the western Great Lakes area as far east as Michigan and Iowa. Its northern extent is in Canada in Saskatchewan, Manitoba, and Ontario. Associations need to be described in California, Arizona, western Texas. It may also occur in West Virginia and Virginia.

**Nations:** CA US

**States/Provinces:** AB? AZ? CA? CO IA ID MB MN MT ND NM NV ON OR SD SK TX? UT WA WI WY

#### ALLIANCE SOURCES

**Authors:** A.S. WEAKLEY 2-96, MOD. K, JT, WCS **Identifier:** A.274

**REFERENCES:** Alexander 1986, Bader 1932, Baker 1982b, Baker and Kennedy 1985, Blackburn et al. 1968b, Blackburn et al. 1968c, Blackburn et al. 1969b, Blackburn et al. 1969d, Blackburn et al. 1971, Bond 1959, Boyce 1977, Bunin 1975a, Bunin 1975c, Coenenberg and Deputit 1979, Cooper and Heidel 1997, Cooper and Pfister 1981, Costello 1954, Cox 1968, Crouch 1983, Curry 1962, DeByle 1985, DeByle 1989, DeByle and Winokur 1985, Dick-Peddie 1993, Dorn 1969, Eyre 1980, Faber-Langendoen et al. 1996, Ferchau 1973, Giese 1975, Girard et al. 1989, Hansen et al. 1988a, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hoffman and Alexander 1987, Holland 1986b, Johnston 1987, Johnston and Hendzel 1985, Keammerer and Peterson 1981, Keammerer and Stoecker 1975, Keammerer and Stoecker 1980, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999, Knight 1994, Komarkova et al. 1988a, Komarkova et al. 1988b, Langenheim 1962, Lewis 1975, Lynn et al. n.d., MNNHP 1993, MTNHP n.d., Marr et al. 1973a, Marr et al. 1973b, Morgan 1969, Mueggler 1988, Mueggler and Campbell 1982, Mueggler and Campbell 1986, Murphy 1982, Mutel 1976, Palmer 1929, Paulsen 1969, Peet 1975, Peet 1981, Plumb 1988, Potter and Moir 1961, Powell 1988a, Reed 1971, Richard et al. 1996, Rominger and Paulik 1983, Sawyer and Keeler-Wolf 1995, Severson and Thilenius 1976, Shepherd 1975, Shepperd 1990, Terwilliger et al. 1979a, Wasser and Hess 1982, Williams and Lillybridge 1983, Youngblood and Mueggler 1981

### FLORISSANT FOSSIL BEDS NM STAND DESCRIPTION

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** The *Populus tremuloides* Forest occupies mesic sites such as heads of drainages, moist slopes along the margins of stands of *Picea pungens* and *Pseudotsuga menziesii*, and some shallow drainages. *Populus tremuloides* trees persist following invasion of clones by conifer trees through succession. Slopes upon which *Populus tremuloides* established were shallow to moderately steep with 2–20% recorded. The aspects varied a great deal, but stands were more common on northeast to northwest exposures. The bark of quaking aspen trees was heavily browsed by elk, up to 3 m high on the trunk.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Populus tremuloides* Forest stands, or clones are relatively small within the monument, rarely exceeding 1.0–1.5 ha. Tree height is related to the age of the clone, where trees in a medium-aged clone were estimated to be approximately 30–35 m tall and a young clone was estimated to have trees measuring from 15–20 m tall. Clone maturity also relates to trunk diameter, as sampled stands averaged 19 cm dbh and 18 cm dbh. The bark of quaking aspen trees was heavily browsed and used for antler-polishing by elk, leaving the lower portion of the trunk roughened and black in color. Many root-sucker shoots were also heavily browsed. Foliar cover for the quaking aspen canopy, of sampled stands, ranged from approximately 60–70%. The associated shrubs were typically from 1–2 m tall, e.g., *Juniperus communis*, *Dasiphora fruticosa*, *Ribes inerme*, and *Salix* spp., provided from 5–10% foliar cover. Graminoids ranged from 0.5–1 m in height, and contributed from 5–10% foliar cover. The most common graminoids present included *Bromus porteri*, *Danthonia parryi*, *Blepharoneuron tricholepis*, and the exotics *Bromus inermis*, *Poa pratensis*, and *Agrostis scabra*. Forbs rarely contributed more than 5% foliar cover under quaking aspen canopies. The most common forbs present included *Thalictrum fendleri*, *Vicia americana*, and *Fragaria* spp. and the monument-rare Colorado columbine

(*Aquilegia caerulea*) was recorded within one quaking aspen clone. Ground cover was predominantly herbaceous litter, ranging from values of 75–80%, with the remaining cover provided by downed wood.

*Populus tremuloides* Forest clones are small and rarely if ever exceed the project minimum mapping unit (0.5 ha). They are, however, easily interpreted from both true color and CIR aerial photography and could be considered as a Park Special for mapping purposes.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Danthonia parryi</i> , <i>Bromus porteri</i> , <i>Festuca arizonica</i> , <i>Poa pratensis</i> , <i>Bromus inermis</i>
Forb	<i>Thalictrum fendleri</i> , <i>Vicia americana</i> , <i>Taraxacum officinale</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Danthonia parryi</i> , <i>Bromus porteri</i> , <i>Poa pratensis</i> , <i>Bromus inermis</i>
Forb	<i>Thalictrum fendleri</i> , <i>Vicia americana</i> , <i>Fragaria virginiana</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Forb	<i>Aquilegia caerulea</i> , <i>Heracleum maximum</i> , <i>Urtica dioica</i> , <i>Oxytropis lambertii</i>

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Populus tremuloides* Forest stands are present along mesic drainages, on moist sites within swales, and at the moist fringe of dense *Picea pungens* and *Pseudotsuga menziesii* stands. Individual and small clones of quaking aspen are intermixed into many other forest and woodland types in the monument. The elevation range occupied includes that of the monument, from approximately 8,450 feet to 8,765 feet for sampled stands. The largest of these stands are located adjacent to the monument on private land.

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 18, 75

##### Note:

This association is found in two different map classes:

- 1) Colorado Blue Spruce - Douglas-fir - Quaking Aspen Forest
- 2) Quaking Aspen Forest

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#### POPULUS TREMULOIDES / JUNIPERUS COMMUNIS FOREST

Quaking Aspen / Common Juniper Forest

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association is known from the mountains of Colorado, Wyoming and Montana, where it occurs in two differing environments: (1) warm, dry sites near the margin of bunchgrass meadows and (2) swales, broad benches or dry flats acting as frost pockets, or where subject to cold-air drainage. This association occurs on nearly all exposures, gentle to moderate slopes (10–18%), and elevations from 9000 to 9720 feet. Stands have a somewhat closed to closed canopy of trees 5–20 m tall, that is dominated or codominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Scattered conifer trees such as *Pseudotsuga menziesii* and species of *Pinus*, *Picea*, and *Abies* may also be present. Common shrubs include *Juniperus communis*, *Acer glabrum*, *Mahonia repens* (= *Berberis repens*), *Dasiphora fruticosa*, *Arctostaphylos uva-ursi*, *Paxistima myrsinites*, *Rosa woodsii*, *Symphoricarpos oreophilus*, and dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus*. The herbaceous layer is not abundant.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** This forest type occupies mesic sites such as heads of drainages, moist slopes along the margins of stands of *Picea pungens* and *Pseudotsuga menziesii*, and some shallow drainages. Slopes upon which *Populus tremuloides* has established are shallow to moderately steep with 10–12% recorded. Aspects vary a great deal, but stands were more common on northeast to northwest exposures. The bark of quaking aspen trees was heavily browsed by elk, up to 3 m high on the trunk.

**Global Environment:** Distribution of these forests is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondly, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). This forest type occurs in two differing environments: (1) warm, dry sites near the margin of bunchgrass meadows and (2) swales, broad benches or dry flats acting as frost pockets, or where subject to cold-air drainage. It occurs on nearly all exposures, gentle to moderate slopes (10-18%), and elevations from 9000 to 9720 feet.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** These forest stands or clones are relatively small within the monument, rarely exceeding 1.0–1.5 ha. Tree height is related to the age of the clone, where trees in a very mature clone were estimated to be approximately 40–45 m tall, and medium-aged clones were estimated to have trees approximately 20–35 m tall. Trunk diameters were recorded for the mature clone, which averaged 27 cm dbh, and the largest dbh recorded was 38 cm. The bark of quaking aspen trees was heavily browsed by elk, leaving the lower portion of the trunk roughened and black in color. Foliar cover for the quaking aspen canopy, of sampled and observed stands, ranged from approximately 60–80%. The associated shrubs were typically from 1–2 m tall, e.g., *Juniperus communis*, *Dasiphora fruticosa*, *Ribes inerme*, and *Rosa woodsii*, provided from 5–50% foliar cover. The higher value was related to dense understories of *Juniperus communis* in more mature stands of quaking aspen. Graminoids ranged from 0.5–1 m in height and contributed from 5–10% foliar cover. The most common graminoids present included *Bromus porteri*, *Danthonia parryi*, and the exotics *Bromus inermis* and *Poa pratensis*. Forbs rarely contributed more than 5% foliar cover under these forest canopies. The most common forbs present included *Thalictrum fendleri*, *Vicia americana*, *Taraxacum officinale*, and *Achillea millefolium*. Ground cover is predominantly herbaceous litter, ranging from values of 75–95%, with the remaining cover provided by downed wood.

Clones rarely exceed the project minimum mapping unit. They are, however, easily interpreted from both true color and CIR aerial photography and could be considered as a Park Special for mapping purposes.

**Global Vegetation:** Stands have a somewhat closed to closed canopy of trees 5-20 m tall, that is dominated or codominated by the cold-deciduous, broad-leave tree *Populus tremuloides*. Scattered conifer trees such as *Pseudotsuga menziesii* and species of *Pinus*, *Picea*, and *Abies* may also be present. Common shrubs include *Juniperus communis*, *Acer glabrum*, *Mahonia repens* (= *Berberis repens*), *Dasiphora fruticosa*, *Arctostaphylos uva-ursi*, *Paxistima myrsinites*, *Rosa woodsii*, *Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus*. The herbaceous layer is not abundant. Common graminoids may include *Bromus porteri*, *Danthonia parryi*, *Elymus trachycaulus*, *Elymus glaucus*, *Bromus carinatus*, *Calamagrostis rubescens*, *Carex siccata* (= *Carex foenea*), *Carex geyeri*, *Carex rossii*, *Festuca thurberi*, and *Hesperostipa comata*. The most common forbs present include *Thalictrum fendleri*, *Vicia americana*, *Taraxacum officinale*, *Achillea millefolium*, *Astragalus flexuosus*, *Fragaria virginiana*, *Pseudocymopterus montanus*, *Thermopsis divaricarpa*, *Campanula rotundifolia*, and *Arnica cordifolia*. Exotic grasses such as the perennial *Poa pratensis*, *Bromus inermis* and the annual *Bromus tectorum* are often common in stands disturbed by grazing.

### Global Dynamics:

## MOST ABUNDANT SPECIES

### Florissant Fossil Beds NM

#### Stratum

Tree

Shrub

Graminoid

Forb

#### Species

*Populus tremuloides*

*Juniperus communis*, *Dasiphora fruticosa*

*Danthonia parryi*, *Bromus porteri*, *Poa pratensis*, *Bromus inermis*

*Thalictrum fendleri*, *Vicia americana*, *Taraxacum officinale*

### Global

#### Stratum

Tree

Shrub

#### Species

*Populus tremuloides*

*Juniperus communis*,

Graminoid	<i>Poa pratensis</i> , <i>Bromus inermis</i>
Forb	<i>Achillea millefolium</i> , <i>Thalictrum fendleri</i> , <i>Vicia americana</i> , <i>Taraxacum officinale</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Danthonia parryi</i> , <i>Bromus porteri</i> , <i>Poa pratensis</i> , <i>Bromus inermis</i>
Forb	<i>Thalictrum fendleri</i> , <i>Vicia americana</i> , <i>Fragaria virginiana</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus tremuloides</i>
Shrub	<i>Juniperus communis</i>
Graminoid	<i>Carex siccata</i>
Forb	<i>Thalictrum fendleri</i> , <i>Fragaria virginiana</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pseudotsuga menziesii</i> , <i>Pinus ponderosa</i>

##### Global

<u>Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

##### SYNONYMY:

- DRISCOLL FORMATION CODE:I.B.3.b. (Driscoll et al. 1984) B
- *Populus tremuloides*/*Juniperus communis* (Bourgeron and Engelking 1994) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G4.

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Populus tremuloides* / *Juniperus communis* Forest stands are present along mesic drainages, on moist sites within swales, and at the moist fringe of dense *Picea pungens* and *Pseudotsuga menziesii* stands. Individual and small clones of quaking aspen are intermixed into many other forest and woodland types in the monument. The elevation range occupied includes that of the monument, from approximately 8450-8765 feet for sampled and observed stands.

**Global Range:** This association is known from the mountains of Colorado, Wyoming and Montana.

**Nations:** US

**States/Provinces:** CO MT? WY

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 82

**Classification Confidence:** 2 **Identifier:** CEG000587

**REFERENCES:** Bourgeron and Engelking 1994, Curry 1962, Driscoll et al. 1984, Johnston 1987, Marr et al. 1973b, Murphy 1982, Peet 1975, Peet 1981, Powell 1988a, Shepherd 1975, Youngblood and Mueggler 1981.

##### Note:

This association is found in two different map classes:

- 1) Colorado Blue Spruce - Douglas-fir - Quaking Aspen Forest
- 2) Quaking Aspen Forest

## II. WOODLAND

### II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland

#### II.A.4.N.a.39. PINUS ARISTATA WOODLAND ALLIANCE

##### Bristlecone Pine Woodland Alliance

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##### PINUS ARISTATA / FESTUCA ARIZONICA WOODLAND

##### Bristlecone Pine / Arizona Fescue Woodland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This is an association confined to exposed, wind-swept ridges and steep slopes in the upper montane and subalpine zones of the southern Rocky Mountains. These open to moderately closed woodlands occur on all aspects, but are most common on drier south- and west-facing slopes. Slopes are typically moderate to steep, but may also be gentle. Soils are typically well-drained, shallow, and skeletal. Stands have an open to moderately closed canopy typically 5-15 m tall that is solely dominated or codominated by *Pinus aristata*. Individual trees may reach 20 m. In some stands trees are clumped with grassy patches interspersed. Other tree species that may be present to codominant vary geographically within its range. *Picea engelmannii* and *Pseudotsuga menziesii* are the most common. *Pinus flexilis* has also been reported as an associate in some stands. *Abies lasiocarpa* and *Populus tremuloides* may be scattered in some stands, but are generally restricted to more mesic sites and are typically absent in the drier southern extent of this association. The understory vegetation ranges from moderately dense to sparse (typically) because sites are dry and often have large amounts of rock cover. The sparse to moderately dense herbaceous layer often dominates the understory. The most common species are typically graminoids, especially species of *Festuca*. This association differs from the *Pinus aristata* / *Trifolium dasyphyllum* Woodland [CEGL000762] by having a higher and more consistent cover of perennial grasses.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** These woodland stands occupy steep, erosive slopes (22–28%) that are at least partially composed of volcanic rock and soil weathered from volcanic rock. The soils are a gritty, silty clay under the stand on Fossil Stump Hill and gravelly under the eastern stand. Stands of bristlecone pine grow from the toeslope to the slope shoulder, where they intermix with *Pinus ponderosa* and *Pseudotsuga menziesii*. The slope exposure is predominantly west to northwest (255–310 degrees), and the elevation is approximately 8350 feet for the two stands known in the monument.

**Global Environment:** This woodland association occurs on semi-xeric sites in the subalpine zone in the southern Rocky Mountains. Elevations range from 2600-3670 m (8500-12,050 feet). Climate is semi-arid, cold temperate with cool summers. Annual precipitation patterns and amounts vary with latitude, but locally the sites are typically xeric on exposed, wind-swept rocky slopes and ridges. These open to moderately closed woodlands occur on all aspects, but are most common on drier south- and west-facing slopes. Slopes are typically moderate to steep, but may also be gentle. Soils are typically well-drained, shallow, skeletal and coarse-textured such as gravelly, sandy loams or loams. Stands occur most frequently on igneous, metamorphic and volcanic substrates such as andesite, granite, gneiss, breccia, tuff, conglomerate, but also occur on sedimentary rocks like sandstone. Exposed bedrock is common. Soil pH is 4.5-6.9, acid to slightly acid.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Two stands are dominated by *Pinus aristata* / *Festuca arizonica* Woodland within the monument and are characterized by canopy trees that are approximately 15 m in height and subcanopy trees to approximately 10 m tall. The stand on Fossil Stump Hill occupies much drier soils and is located on a physically smaller hill than the eastern stand, consequently, it is more depauperate in terms of understory species. The largest *Pinus aristata* tree recorded for a sampling plot on Fossil Stump Hill measured 61.6 cm dbh, and the largest tree in the easternmost stand measured 33.7 cm. Both stands are reproducing, with seedling and sapling *Pinus aristata* trees present on the slopes. Some trees were showing chlorosis and browning of needles (possibly normal leaf drop conditions for this species), and signs of historic logging (axe-cut stumps) were observed. Crown cover for both stands was approximately 25–30% for both the canopy and subcanopy trees. Foliar cover for shrubs in all layers, e.g., *Pinus aristata* saplings, *Ribes cereum*, *Dasiphora fruticosa*, and *Artemisia frigida*, averages less than 5% within a stand. Graminoids provide foliar cover of approximately 10%, with *Festuca arizonica*, *Danthonia parryi*, *Muhlenbergia montana*, and *Koeleria macrantha* the most commonly observed species. A number of forb species are present within these stands, but the contribution to foliar cover is less



than 5%. The most common forbs include *Besseyia plantaginea*, *Maianthemum stellatum*, *Geranium caespitosum*, and *Achillea millefolium*. Ground cover is predominantly herbaceous litter under one stand (85%) and small gravel and herbaceous litter under the other (55% and 35% respectively). Lichens are present, providing up to 10% ground cover.

The two stands of *Pinus aristata* / *Festuca arizonica* Woodland are relatively small, but are close to the project minimum mapping unit. Some signature confusion with dense ponderosa pine may occur with true color aerial photos; however, the location of both stands is known which will guide interpretation.

**Global Vegetation:** Stands have an open to moderately closed canopy typically 5-15 m tall that is solely dominated or codominated by the long-lived evergreen, needle-leaved tree *Pinus aristata*. Individual trees may reach 20 m. In some stands trees are clumped with grassy patches interspersed. Other tree species that may be present to codominant vary geographically within its range. *Picea engelmannii* and *Pseudotsuga menziesii* are the most common. *Picea pungens* is common in the southern extent where stands occur at high elevations, and *Pinus flexilis* has also been reported as an associate in some stands. *Abies lasiocarpa* and *Populus tremuloides* may be scattered in some stands, but are generally restricted to more mesic sites and are typically absent in the drier southern extent of this association.

The understory vegetation ranges from moderately dense to typically sparse because sites are dry and often have large amounts of rock cover. The sparse to moderately dense herbaceous layer often dominates the understory. The most common species are typically graminoids, especially species of *Festuca*. Common species may include *Calamagrostis purpurascens*, *Carex* spp., *Danthonia parryi*, *Festuca arizonica*, *Festuca brachyphylla*, *Festuca idahoensis*, *Festuca thurberi*, *Koeleria macrantha*, *Muhlenbergia filiculmis*, *Muhlenbergia montana*, *Poa fendleriana*, and *Trisetum spicatum*. Forbs are generally sparse, but *Trifolium dasyphyllum* may reach 10% cover. Other scattered forbs may include species of *Achillea*, *Antennaria*, *Artemisia*, *Arenaria*, *Arnica*, *Astragalus*, *Campanula*, *Erigeron*, *Hymenoxys*, *Penstemon*, *Polemonium*, *Sedum*, *Senecio*, and *Thalictrum*. This association differs from the *Pinus aristata* / *Trifolium dasyphyllum* Woodland [CEGL000762] by having a higher and more consistent cover of perennial grasses.

**Global Dynamics:** *Pinus aristata* is a slow-growing, extremely long-lived tree (Brunstein and Yamaguchi 1992). Several individuals over 2000 years old have been found in Colorado. DeVelice et al. (1986) observed that it occurs in open park-like stands and on steep rocky slopes where *Picea engelmannii* - *Abies lasiocarpa* stands are excluded by drought. Fire is important in the grass-dominated stands but is rarely intense enough to result in tree-killing crown fires (DeVelice et al. 1986). In some stands, suppression of grass fires has allowed encroachment of the trees into meadows (Larson and Moir 1987). Forage production is good in some stands, but rarely utilized by livestock because stands are steep and generally remote which makes access difficult.

Peet (1978b, 1981) noted that *Pinus aristata* is dominant at higher elevations in much of the southern Rocky Mountains, where *Pinus flexilis* is restricted to lower elevations. This is attributed to apparent competitive exclusion, because *Pinus flexilis* is dominant at high elevations in northern Colorado, Wyoming and Montana.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus aristata</i>
Shrub	<i>Ribes cereum</i>
Graminoid	<i>Festuca arizonica</i> , <i>Danthonia parryi</i>
Forb	<i>Besseyia plantaginea</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus aristata</i>
Shrub	<i>Ribes cereum</i>
Graminoid	<i>Festuca</i> spp.

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus aristata</i> , <i>Pinus ponderosa</i>
Shrub	<i>Ribes cereum</i> , <i>Dasiphora fruticosa</i> , <i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Danthonia parryi</i>
Forb	<i>Besseyia plantaginea</i> , <i>Maianthemum stellatum</i>

**Global**

**Stratum**

Tree

Shrub

Graminoid

**Species**

*Pinus aristata*

*Ribes cereum*

*Festuca* spp.

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Graminoid

**Species**

*Muhlenbergia montana*

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

- *Pinus aristata* / *Trifolium dasyphyllum* Woodland [CEGL000762]

**SYNONYMY:**

- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) B
- *Pinus aristata*/*Festuca arizonica* (Bourgeron and Engelking 1994) =

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G4.

**Global Classification Comments:** This association differs from the *Pinus aristata* / *Trifolium dasyphyllum* Woodland [CEGL000762] by having a higher and more consistent cover of perennial grasses.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Pinus aristata* / *Festuca arizonica* Woodland occurs as only two stands, one on the northwest-facing slope of Fossil Stump Hill and the other on the northwest-facing slope of the large hill east of the Visitor Center. A small clump (8 to 10 individuals) of *Pinus aristata* trees are present on the downstream portion of a livestock pond and dam, just south of Lower Twin Rocks Road. Individual *Pinus aristata* trees are occasionally observed in other woodland types within the monument, primarily on the large hill east of the Visitor Center.

**Global Range:** This association is known from the southern Rocky Mountains and from the Colorado Plateau regions of Colorado and New Mexico.

**Nations:** US

**States/Provinces:** CO NM

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 24, 31

**Classification Confidence:** 2 **Identifier:** CEGL000759

**REFERENCES:** Bourgeron and Engelking 1994, Brunstein and Yamaguchi 1992, DeVelice 1983, DeVelice et al. 1986, Driscoll et al. 1984, Johnston 1987, Komarkova et al. 1988a, Larson and Moir 1987, Peet 1978b, Peet 1981, Shepherd 1975, Stewart 1940

**II.A.4.N.a.32. PINUS PONDEROSA WOODLAND ALLIANCE**

Ponderosa Pine Woodland Alliance

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**PINUS PONDEROSA / BROMUS INERMIS SEMI-NATURAL WOODLAND**

Ponderosa Pine / Smooth Brome Semi-natural Woodland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This is a woodland of native *Pinus ponderosa* with an exotic grass understory. While currently reported from the Colorado Front Range and southwestern Utah, it undoubtedly is more widespread in the West. *Bromus inermis* has been

seeded in thousands of hectares as pasture grass throughout the western U.S. It requires some sort of subirrigation or moisture, so is found escaped into riparian areas, draws and hollows. In some places the seeding took place beneath mature *Pinus ponderosa* trees, and in other locations, *P. ponderosa* is slowly invading the *Bromus inermis* pasture. Stands are dominated by *Bromus inermis* with 30-40% foliar cover, with an open, park-like structure to the overstory canopy of trees, either mature or young sapling size, contributing around 20% canopy cover.

### ENVIRONMENTAL DESCRIPTION

#### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** Native grasslands, formerly converted to exotic pasture grasses, predominantly *Bromus inermis*, are being invaded by young *Pinus ponderosa* trees. The young trees occupy the pasture area adjacent to established woodland and forest stands, as an extension of those stands on slopes of approximately 5%. Stands of young ponderosa pine trees grow on all aspects at elevations around 8500 feet. Stands growing from previously disturbed soils, resulting from potato and small grain farming, are rooted in a gravel substrate derived from Pikes Peak granite bedrock, with little or no soil development.

**Global Environment:** Stands growing from previously disturbed soils, resulting from potato and small grain farming, are rooted in a gravel substrate derived from granite or sandstone bedrock, with little or no soil development. It occurs on gently sloping drainages on moderately well-drained sandy loam soil. Elevation is 6700 to 8500 feet. In one stand the young trees occupy the pasture area adjacent to established woodland and forest stands, as an extension of those stands on slopes of approximately 5%. In other stands, mature trees are the overstory canopy.

### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Young ponderosa pine trees invading former pastures supporting exotic grasses are approximately 2–5 m tall and average approximately 13 cm dbh. These trees are probably between 15 and 25 years of age. Foliar cover provided by *Pinus ponderosa* was approximately 20% for the stand sampled. Graminoids contribute approximately 40% foliar cover with most provided by the exotic *Bromus inermis*. Native grasses invading this site include *Muhlenbergia filiculmis* (approximately 10% foliar cover), *Festuca arizonica*, *Koeleria macrantha*, *Elymus elymoides*, and *Bouteloua gracilis*. Forbs are diverse, but account for less than 5% foliar cover. The most abundant forb was the exotic *Convolvulus arvensis*, along with *Hymenoxys richardsonii*, *Oxytropis lambertii*, *Gaura coccinea*, and *Heterotheca fulcrata* (= *Chrysopsis fulcrata*). Ground cover consisted of predominantly herbaceous litter (approximately 55% cover) and gravel and bare soil (approximately 40% cover). These soils were disturbed historically to seed the smooth brome pasture, and it is also possible that some site leveling occurred, disturbing the soil structure.

These woodland stands are often small, below the minimum mapping unit for the project. They are readily identifiable on both true color and CIR aerial photographs.

**Global Vegetation:** *Pinus ponderosa* comprises the tree canopy with over 20% cover as young, invading trees into the grassland or as mature, very tall trees. These soils were disturbed historically to seed *Bromus inermis* pastures, and it is also possible that some site leveling occurred, disturbing the soil structure. Graminoids contribute approximately 40% foliar cover with most provided by the exotic *Bromus inermis* and presence of *Poa pratensis*. Native grasses invading these stands include *Muhlenbergia filiculmis* (approximately 10% foliar cover), *Festuca arizonica*, *Koeleria macrantha*, *Elymus elymoides*, and *Bouteloua gracilis*. Forbs are diverse, but account for less than 5% foliar cover. The most abundant forb was the exotic *Convolvulus arvensis*, *Heterotheca villosa*, *Lupinus argenteus*, *Lotus utahensis*, *Achillea millefolium*, along with *Hymenoxys richardsonii*, *Oxytropis lambertii*, *Gaura coccinea*, and *Heterotheca fulcrata* (= *Chrysopsis fulcrata*).

#### Global Dynamics:

### MOST ABUNDANT SPECIES

#### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Shrub	<i>Artemisia frigida</i>
Graminoid	<i>Bromus inermis</i> , <i>Muhlenbergia filiculmis</i>
Forb	<i>Convolvulus arvensis</i>

**Global**

**Stratum**

Tree  
Graminoid

**Species**

*Pinus ponderosa*  
*Bromus inermis*

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Tree  
Shrub  
Graminoid  
Forb

**Species**

*Pinus ponderosa*  
*Artemisia frigida*  
*Bromus inermis*, *Muhlenbergia filiculmis*, *Festuca arizonica*  
*Convolvulus arvensis*, *Hymenoxys richardsonii*

**Global**

**Stratum**

Tree  
Graminoid

**Species**

*Pinus ponderosa*  
*Bromus inermis*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Graminoid

**Species**

*Agropyron cristatum*

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** GW

**Global Classification Comments:**

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** Young stands of *Pinus ponderosa* / *Bromus inermis* Woodland are invading native and exotic grasslands throughout the monument, due to moist climatic conditions conducive to tree establishment and fire suppression. The most extensive young tree stands occur north of the Boulder Creek drainage and west of the Hornbek Homestead. *Pinus ponderosa* invasion of historic, terraced potato fields may present a conflict with interpretive programs.

**Global Range:** This association has been described from southern Utah and central Colorado, and is likely to occur anywhere within the Ponderosa Pine belt where *Bromus inermis* has been seeded as hay pasture.

**Nations:** US

**States/Provinces:** UT CO

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plot 26

**Classification Confidence:** 3 **Identifier:** Cegl002943

**REFERENCES:**

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**PINUS PONDEROSA / CERCOCARPUS MONTANUS WOODLAND**

Ponderosa Pine / Mountain-mahogany Woodland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This woodland occurs on the driest aspects that support coniferous woodlands of *Pinus ponderosa* in the southern Rocky Mountains. Typically, this association occurs on dry rocky hillsides just above the shrubland zone, on shallow, rocky loam soils. Aspects are predominately south, southeast and southwest, on ridgetops and adjacent upper slopes that are moderate to steep (18-60%), at 5570-8900 feet elevation. This is an open woodland with scattered trees, generally with less than 50% cover of

*Pinus ponderosa*, *Juniperus scopulorum* and *Pseudotsuga menziesii* individuals may be present. The community is open in appearance with a matrix of shrubs, predominantly *Cercocarpus montanus* and *Ribes cereum*. Other shrubs present may include *Artemisia frigida*, *Purshia tridentata*, *Yucca glauca*, and *Quercus gambelii*. Herbaceous cover ranges from 10-70%. Grasses are typically more abundant than forbs and commonly include one or more of the following species: *Bromus tectorum*, *Elymus albicans*, *Festuca arizonica*, *Carex rossii*, *Elymus lanceolatus*, *Hesperostipa comata*, *Bouteloua gracilis*, *Muhlenbergia montana*, and *Koeleria macrantha* (= *Koeleria cristata*). Forb species include *Artemisia ludoviciana*, *Geranium* spp., *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Grindelia subalpina*, *Argentina anserina*, *Cryptantha thyrsoflora*, and *Eriogonum umbellatum*.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** This woodland type occupies slopes comprised of predominantly Pikes Peak granite bedrock-derived gravel, rocks, and occasional boulders. One stand differed in that the bedrock was volcanic, a welded tuff, but still with a gravel, rock, and boulder substrate. Sites occupied by this type may be found monument-wide, because it was sampled from approximately 8400–8900 feet in elevation. This type occurs on south, east, and west exposures, ridgetops and adjacent upper slopes, and hilltops with a past logging history. The trees on these sites are heavily infested with mistletoe (*Arceuthobium americanum*), which leads to stunting and abnormal needle development. Slope exposures along ridgelines, on ridgetops, and hillslopes can vary from east and south to west; the recorded stands occupied moderately steep (7–21%) slopes oriented at 141 to 260 degrees.

**Global Environment:** This woodland occurs on the driest aspects that support coniferous woodlands of *Pinus ponderosa* in the southern Rocky Mountains. Typically, this association occurs on dry rocky hillsides just above the shrubland zone, on shallow, rocky loam soils. Aspects are predominately south, southeast and southwest, on ridgetops and adjacent upper slopes that are moderate to steep (18-60%), at 5570-8900 feet elevation.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This woodland type is characterized by 10–15 m tall ponderosa pine trees providing approximately 15–25% foliar cover. A sparse subcanopy or tall-shrub layer of sapling ponderosa pine may also be present, but generally contributes less than 5% foliar cover. Ponderosa pine trees measure an average of 24 cm dbh in this type, and the largest tree measured was 38 cm dbh. The shrubs present are generally short, from 1–2 m tall, and provide approximately 5–15% foliar cover within the stand. The common shrub species present include *Cercocarpus montanus*, *Ribes cereum*, and the dwarf-shrubs *Artemisia frigida* and *Yucca glauca*. Graminoids provide approximately 5–10% foliar cover and include *Festuca arizonica*, *Bouteloua gracilis*, *Muhlenbergia montana*, *Koeleria macrantha*, *Carex inops*, and *Elymus elymoides*. Forbs provide only sparse foliar cover, from 2–3% in most stands. The more common forbs include *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Geranium caespitosum*, *Grindelia subalpina*, *Argentina anserina*, and *Cryptantha thyrsoflora*. Ground cover for the stands is predominantly gravel eroded from Pikes Peak granite bedrock, e.g., 35–50% cover from gravel was recorded in sampled stands. Herbaceous litter provided from 20–50% ground cover, and on one site approximately 30% cover from downed wood was present. A few *Pinus contorta* trees were present in a small stand in the southern portion of the monument and two or three questionable stands scattered in the northern portion. In the southern stand, trees that have typical *Pinus contorta* features, e.g., 2-needle, shorter than those of *Pinus ponderosa* and smallish bristle-tipped cone scales, are present. However, the stand also contains mistletoe-infested *Pinus ponderosa* trees that have both 2- and 3-needle fascicles, and some of the needles are shorter than normal due to the stress of the mistletoe and dryness of the site. The canopy *Pinus contorta* averaged 17 cm dbh.

This type may be interpreted and mapped as part of a woodland alliance that includes the associations mentioned above. It is distinguishable from *Pinus ponderosa* / *Festuca arizonica* Woodland (CEGL000856) on both true color and CIR aerial photography because of the presence of sparse shrubs.

**Global Vegetation:** This woodland type comprises dry foothill vegetation with scattered trees, generally with less than 50% cover of *Pinus ponderosa*. *Juniperus scopulorum* and *Pseudotsuga menziesii* individuals may be present. The community is open in appearance with a matrix of shrubs, predominantly *Cercocarpus montanus* and *Ribes cereum*. Other shrubs present may include *Artemisia frigida*, *Purshia tridentata*, *Yucca glauca*, and *Quercus gambelii*. Herbaceous cover ranges from 10-70%. Grasses are typically more abundant than forbs and commonly include one or more of the following species: *Bromus tectorum*, *Elymus albicans*, *Festuca arizonica*, *Carex rossii*, *Elymus lanceolatus*, *Hesperostipa comata*, *Bouteloua gracilis*, *Muhlenbergia montana*, and *Koeleria macrantha* (= *Koeleria cristata*). Forb species include *Artemisia ludoviciana*, *Geranium* spp., *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Grindelia subalpina*, *Argentina anserina*, *Cryptantha thyrsoflora*, and *Eriogonum umbellatum*.

### Global Dynamics:

### MOST ABUNDANT SPECIES

#### Florissant Fossil Beds NM

##### Stratum

##### Species

Tree *Pinus ponderosa*  
Shrub *Cercocarpus montanus*, *Ribes cereum*, *Artemisia frigida*, *Yucca glauca*  
Graminoid *Festuca arizonica*, *Bouteloua gracilis*, *Muhlenbergia montana*  
Forb *Heterotheca fulcrata*, *Grindelia subalpina*, *Argentina anserina*

#### Global

##### Stratum

##### Species

Tree *Pinus ponderosa*  
Shrub *Cercocarpus montanus*, *Ribes cereum*

### CHARACTERISTIC SPECIES

#### Florissant Fossil Beds NM

##### Stratum

##### Species

Tree *Pinus ponderosa*  
Shrub *Cercocarpus montanus*, *Ribes cereum*, *Artemisia frigida*  
Graminoid *Festuca arizonica*, *Bouteloua gracilis*, *Muhlenbergia montana*, *Koeleria macrantha*,  
*Elymus elymoides*  
Forb *Heterotheca fulcrata*, *Grindelia subalpina*, *Argentina anserina*

#### Global

##### Stratum

##### Species

Tree *Pinus ponderosa*  
Shrub *Cercocarpus montanus*, *Ribes cereum*  
Graminoid *Festuca arizonica*, *Bouteloua gracilis*, *Muhlenbergia montana*, *Koeleria macrantha*

### OTHER NOTEWORTHY SPECIES

#### Florissant Fossil Beds NM

##### Stratum

##### Species

Tree *Pinus contorta*  
Forb *Allium cernuum*, *Pediocactus simpsonii*

#### Global

##### Stratum

##### Species

### GLOBAL SIMILAR ASSOCIATIONS:

#### SYNONYMY:

- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) B
- *Pinus ponderosa*/*Cercocarpus montanus* (Bourgeron and Engelking 1994) =

### GLOBAL STATUS AND CLASSIFICATION COMMENTS

Global Conservation Status Rank: G4.

Global Classification Comments:

### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Pinus ponderosa* / *Cercocarpus montanus* Woodland occupies moderately steep slopes of 8–16% on ridges and hills within the monument. The aspect is southerly or westerly, ranging from 98–196 degrees and 213–231 degrees. This vegetation type is readily observable on the hill east of the Visitor Center and the hill north of Hornbek Homestead.

**Global Range:** This association is known primarily from the Colorado Rocky Mountains. It is thought to occur as far north as the Black Hills of Wyoming and South Dakota.

**Nations:** US

**States/Provinces:** CO WY? SD?

### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 28, 54, 72, 90

**Classification Confidence:** 1    **Identifier:** CEG000851

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Hess and Alexander 1986, Hess and Wasser 1982, Johnston 1987, Kahler 1973, Lynn et al. n.d., Peet 1975, Peet 1981, Thilenius 1971, Thilenius 1972

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## PINUS PONDEROSA / FESTUCA ARIZONICA WOODLAND

Ponderosa Pine / Arizona Fescue Woodland

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### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association occurs on all aspects and landscape positions within an elevational range of 2100-2900 m (7200-9500 feet), in locations throughout the mountains of the southwestern U.S. and western Texas. Slopes are gentle to very steep. This association is the coolest and wettest of grassy *Pinus ponderosa* types, and soils are typically deeper than other related *Pinus* types. This woodland has an open park-like character with scattered trees with not more than 50% cover and abundant herbaceous understory. Shrub cover is sparse. *Pinus ponderosa* is the dominant tree and the climax overstory species. *Pseudotsuga menziesii* is occasionally present. Dominance by grasses and sometimes forbs is diagnostic for this type. *Festuca arizonica* and *Muhlenbergia montana* are consistently present. *Bouteloua gracilis* and *Danthonia parryi* can be very abundant in relatively dry or wet stands, respectively. In the southern portion of its range other species may be present in the canopy, including *Pinus edulis*, *Pinus cembroides*, and *Pinus strobiformis*. Shrubs are scarce but are often present; species vary with latitude and include *Quercus gambelii*, *Artemisia tridentata*, *Chrysothamnus depressus*, *Ribes cereum*, *Ceanothus fendleri*, *Symphoricarpos oreophilus*, and *Mahonia repens*.

### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Slopes supporting a graminoid understory for stands are moderate to steep (approximately 10–40%) and mostly oriented to the southeast and southwest (164–240 degrees). The soils are predominantly gravel eroded from Pikes Peak granite bedrock, although an extensive herbaceous litter layer is usually present. A dense *Pinus ponderosa* / *Festuca arizonica* Forest occupies northeast- to northwest-facing (77 to 301 degrees) slopes of small hills and ridges, growing on the mid- to the toeslope with moderate to steep (8–33%) slopes. On larger hills and ridges, the same midslope habitat would be occupied by *Pseudotsuga menziesii* / *Juniperus communis* Forest (CEGL000439), and the toeslope would likely support *Picea pungens* / *Juniperus communis* Forest (CEGL000392).

**Global Environment:** This association occurs on all aspects and landscape positions within an elevational range of 2100-2900 m (7200-9500 feet). Slopes are gentle to very steep. Soils are predominantly Borolls, with low coarse fragments. The habitat is the coolest and wettest of grassy *Pinus ponderosa* types, and soils are typically deeper than other related *Pinus* types.

### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This type consists of sparse stands on south-facing slopes and dense stands on north-facing slopes and hillsides. This sparse woodland type is characterized by ponderosa pine trees averaging from 15–20 m tall, but sparse, only contributing approximately 20% foliar cover for the stand. Since these trees are growing with little competition, they are larger, averaging 32 cm dbh. The largest *Pinus ponderosa* measured in a sample plot was 52 cm dbh for this type. A few *Pinus ponderosa* saplings are present as subcanopy trees or tall shrubs, but contribute 5% or less foliar cover. Short or dwarf-shrubs, including *Ribes cereum*, *Juniperus communis*, *Cercocarpus montanus*, and *Artemisia frigida*, also provide less than 5% foliar cover for the type. Graminoids present include *Festuca arizonica*, *Muhlenbergia montana*, *Bouteloua gracilis*, *Danthonia parryi*, *Schizachyrium scoparium*, *Koeleria macrantha*, *Elymus elymoides*, and *Carex inops*. The graminoids rarely contribute more than 2% foliar cover individually and from 5–15% foliar cover among all the graminoids present. Forbs rarely exceed 1% foliar cover by individual species, and are typically less than 5% foliar cover in a sample plot. The most common and abundant forbs present include *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Geranium caespitosum*, *Argentina anserina*, *Hymenoxys richardsonii*, and *Allium cernuum*. Ground cover is typically high, with approximately 90–95% related to pine needles and mast, and most of the remainder downed woody litter. For one site sampled, only 50% of the ground cover was herbaceous litter; most of the remainder was gravel derived from Pikes Peak granite bedrock. Lichens and mosses are typically present and may contribute up to 5% ground cover for a plot. Relatively dense stands provide from 60–75% foliar cover over a depauperate understory. The trees of one stand were estimated to be 15 m tall and in another, approximately 25–30 m tall. The trees were very uniform in age, averaging 19 cm dbh for both stands and for all trees measured (66 individuals). The largest *Pinus ponderosa* tree encountered in sampled stands measured 32 cm dbh. *Pinus ponderosa* is the only tree species present in both the canopy and in the subcanopy of dense stands (less than 5% foliar cover). No shrubs were recorded for vegetation plots sampled in this association, although scattered *Juniperus communis* and *Ribes cereum* shrubs were noted to be nearby one sample plot. Graminoids provided less than 5% foliar cover and included *Danthonia parryi*, *Bouteloua gracilis*, *Festuca arizonica*, *Koeleria macrantha*, and *Elymus elymoides*, among other grass species. Forbs provided less

than 2% foliar cover within the sample plots and included *Besseyia plantaginea*, *Geranium caespitosum*, *Argentina anserina*, *Cerastium arvense ssp. strictum* (= *Cerastium strictum*), and *Solidago* sp. Ground cover associated with these forest stands was 95% litter, to 10 cm deep, with the remainder of downed wood.

*Pinus ponderosa* / *Festuca arizonica* Woodland (CEGL000856) is similar to *Pinus ponderosa* / *Cercocarpus montanus* Woodland (CEGL000851) on south-facing slopes in the monument. It will be possible to interpret from both true color and CIR aerial photographs, due to the lack of shrub cover within canopy openings. However, the units or polygons may be below the project minimum mapping unit and combining with ponderosa pine / mountain mahogany stands may be required. Dense *Pinus ponderosa* / *Festuca arizonica* Woodland occupies habitat normally attributed to stands of *Pseudotsuga menziesii* / *Juniperus communis* Forest (CEGL000439), except that the physical structural features, e.g., hills and ridges, are smaller. Aerial photo signatures for both of these associations are similar on true color and on CIR.

**Global Vegetation:** *Pinus ponderosa* is the dominant tree and the climax overstory species. *Pseudotsuga menziesii* is occasionally present. Dominance by grasses and sometimes forbs is diagnostic for this type. Shrubs, when present never exceed 5% cover. *Festuca arizonica* and *Muhlenbergia montana* are consistently present. *Bouteloua gracilis* and *Danthonia parryi* can be very abundant in relatively dry or wet stands, respectively. At high elevations in the Trans-Pecos mountains of Texas and on sky islands of Arizona, other species may be present in the canopy, including *Pinus edulis*, *Pinus cembroides*, and *Pinus strobiformis*. Shrubs are scarce but are often present; species vary with latitude and include *Quercus gambelii*, *Artemisia tridentata*, and *Chrysothamnus depressus*. The understory is densely grassy with medium-tall grasses, including *Piptochaetium fimbriatum*, *Piptochaetium pringlei*, *Achnatherum lobatum* (= *Stipa lobata*), *Bothriochloa barbinodis* (= var. *barbinodis*), *Schizachyrium scoparium* var. *scoparium* (= *Schizachyrium scoparium ssp. neomexicanum*), *Muhlenbergia rigida*, *Muhlenbergia montana*, *Elymus elymoides*, and *Panicum bulbosum*. Other species include *Allium cernuum*, *Campanula rotundifolia*, *Silene laciniata*, and *Ageratina rothrockii* (= *Eupatorium rothrockii*).

**Global Dynamics:** The heavy grass cover in the understory favors surface fires; the absence of fire would tend to result in denser tree canopy cover and subsequently reduced grass cover (DeVelice et al. 1986). Overgrazing has been widespread and has reduced, and in many cases even eliminated, *Festuca arizonica* from stands. Weedy species such as *Bromus tectorum*, *Tetraneuris acaulis*, *Poa pratensis*, *Taraxacum officinale*, and *Gutierrezia sarothrae* indicate overgrazing. Burning can stimulate *Ceanothus fendleri* on some sites in northern New Mexico and central Arizona.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Shrub	<i>Ribes cereum</i> , <i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Danthonia parryi</i>
Forb	<i>Heterotheca fulcrata</i> , <i>Geranium caespitosum</i> , <i>Argentina anserina</i> , <i>Besseyia plantaginea</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Shrub	<i>Ribes cereum</i> , <i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Bouteloua gracilis</i> , <i>Carex inops ssp. heliophila</i>
Forb	<i>Heterotheca fulcrata</i> , <i>Geranium caespitosum</i> , <i>Argentina anserina</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Forb	<i>Pediocactus simpsonii</i>



**Global  
Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**SYNONYMY:**

- *Pinus ponderosa*/*Festuca arizonica* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) B

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G4.

**Global Classification Comments:**

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Pinus ponderosa* / *Festuca arizonica* Woodland occupies slopes, from toeslope to upper slope, on hills and ridges at mid-elevations (8265-8600 feet) within the monument. Dense stands occupy the north-facing slopes of low hills and ridges, a habitat normally occupied by *Pseudotsuga menziesii* / *Juniperus communis* Forest (CEGL000439) on larger topographic features. Forest stands of ponderosa pine were observed at the northern and southern ends of the monument at approximately 8375 feet elevation and approximately 8600 feet elevation.

**Global Range:** This association is known from mountains in Colorado, New Mexico, Arizona and the Trans-Pecos Mountains (Mt. Livermore in the Davis Mountains) of Texas.

**Nations:** US

**States/Provinces:** AZ CO NM TX

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 20, 27, 59, 60, 61, 62, 65, 84

**Classification Confidence:** 1 **Identifier:** CEGL000856

**REFERENCES:** Alexander et al. 1987, Bourgeron and Engelking 1994, Clary 1978, Clary and Pearson 1969, Costello 1944a, Costello 1954, Costello and Schwan 1946, DeVelice 1983, DeVelice and Ludwig 1983a, DeVelice et al. 1986, Diamond 1993, Driscoll et al. 1984, Fitzhugh et al. 1987, Hanks et al. 1983, Johnson 1945, Johnson 1953, Johnson 1956a, Johnson and Klipple 1946, Johnson and Niederhof 1941, Johnson and Reid 1958, Johnson and Reid 1964, Johnston 1987, Komarkova et al. 1988a, Larson and Moir 1987, Merkle 1962, Moir and Ludwig 1979, Nichol 1937, Shepherd 1975, Smith 1967, Swift 1974, USFS 1983b

**II.A.4.N.d. Temporarily flooded temperate or subpolar needle-leaved evergreen woodland**

**II.A.4.N.d.7. PICEA PUNGENS TEMPORARILY FLOODED WOODLAND ALLIANCE**

Blue Spruce Temporarily Flooded Woodland Alliance

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**PICEA PUNGENS / BETULA OCCIDENTALIS WOODLAND**

Blue Spruce / Water Birch Woodland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This association is known from Colorado and possibly northern New Mexico. It is a cool, moist riparian woodland occurring in deep, narrow canyons in the foothills and at lower montane elevations of 2200-2700 m. *Betula occidentalis* forms a thick band in deep, subirrigated soils along narrow floodplains, streambanks and terraces, with branches overhanging the stream. Mature *Picea pungens* dominates the canopy (10-60% cover), though *Populus tremuloides* may be present as well. *Betula occidentalis* is always present in the shrub understory (20-40% cover), often joined by *Alnus incana*. Other shrubs include *Salix exigua*, *Salix bebbiana*, and *Cornus sericea*. *Equisetum arvense* is always present in the sparse or dense herbaceous layer. Common associates may include forbs such as *Rudbeckia laciniata*, *Heracleum maximum*, *Fragaria virginiana*, *Mertensia ciliata*, and the graminoid *Calamagrostis canadensis*.

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This woodland type is found along low to moderately sloped drainages (3–10%) with narrow floodplains. The drainages are oriented to the west and to the north. The substrate within the streambed tends to be rocky or gravelly and covered by herbaceous and woody litter under stands.

**Global Environment:** This association is a cool, moist riparian woodland occurring in deep, narrow canyons in the foothills and at lower montane elevations (2200–2700 m) in Colorado and possibly northern New Mexico. *Betula occidentalis* forms a thick band in deep, subirrigated soils along narrow floodplains, streambanks and terraces.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** These woodlands are dominated both in the emergent and canopy layers by *Picea pungens* with significant foliar cover provided by *Populus tremuloides*. As emergent trees, these species may reach from 30–35 m in height. In the canopy layer, they are typically in the 20–25 m height class. The subcanopy layer was dominated by these tree species, and also by 8–10 m tall *Betula occidentalis* shrubs. The emergent trees provide approximately 10% foliar cover in sampled stands, while the canopy trees provide approximately 35% (one sampled stand had only 5% canopy cover). Subcanopy trees provide approximately 30% foliar cover, however, one site recorded only 8% foliar cover in the subcanopy. Tree diameters in sampled stands ranged from an average of 15–26 cm for *Populus tremuloides* to 21–24 cm for *Picea pungens*. The largest trees sampled were a 47 cm dbh *Picea pungens* and a 42 cm dbh *Populus tremuloides*. Tall shrubs, dominated by *Betula occidentalis* (6–10 m tall), provided foliar cover from 10–30%, while short shrubs (1–2 m tall), e.g., *Juniperus communis*, *Dasiphora fruticosa*, and *Betula occidentalis*, were estimated to cover approximately 5% of the stand floor. Graminoids provided from 35–50% foliar cover, with *Calamagrostis canadensis*, *Agrostis scabra*, *Bromus inermis*, and *Poa pratensis* the most common grasses observed. Forbs provided approximately 20% foliar cover, with *Thalictrum fendleri*, *Equisetum arvense*, *Cirsium scariosum* (= *Cirsium tioganum*), and *Fragaria virginiana*, the most abundant among many other species. Ground cover was predominantly herbaceous litter, from 85–95% and approximately 15% downed wood.

This woodland will be difficult to interpret separately from Colorado blue spruce forest stands, except for the identified locations. The identified locations represent the only stands of this type observed during the study. The few *Betula occidentalis* shrubs that do appear in the open resemble tall willow species such as *Salix monticola* and will likely be indistinguishable from them on aerial photography.

**Global Vegetation:** *Picea pungens* dominates the canopy with 10–60% cover. Other trees that may be present include *Populus tremuloides* (5–30% cover). The shrub canopy is dominated by *Betula occidentalis* with 20–40% cover. Other shrubs that may be present include *Alnus incana* (10–35% cover), *Salix exigua* (10–30%), *Salix bebbiana* (10%), and *Cornus sericea* (10%). The herbaceous undergrowth can be dense to open. Forb species that may be present include *Rudbeckia laciniata* (1–15%), *Heracleum maximum* (1–15%), *Fragaria virginiana* (1–5%), *Mertensia ciliata* (1–5%), and *Equisetum arvense* (1–10% cover). Graminoid species that may be present include *Calamagrostis canadensis* (1–40%), *Agrostis scabra*, *Bromus inermis*, and *Poa pratensis*.

**Global Dynamics:** This plant association appears to be stable and late-seral. In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* appears to be a climax riparian species. *Picea pungens* will remain until removed or damaged by a catastrophic flood. *Picea pungens* is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. *Betula occidentalis* can tolerate flooding but not permanent inundation (Hansen et al. 1988). Fire disturbance results in *Betula occidentalis* resprouting and the replacement of this type with an early-seral plant association such as *Populus tremuloides* / *Betula occidentalis*.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Populus tremuloides</i>
Shrub	<i>Betula occidentalis</i>
Graminoid	<i>Calamagrostis canadensis</i> , <i>Agrostis scabra</i>
Forb	<i>Equisetum arvense</i> , <i>Achillea millefolium</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Populus tremuloides</i>
Shrub	<i>Betula occidentalis</i>

Forb *Equisetum arvense*

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Populus tremuloides</i>
Shrub	<i>Betula occidentalis</i>
Graminoid	<i>Calamagrostis canadensis</i>
Forb	<i>Equisetum arvense</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Tree	<i>Picea pungens</i> , <i>Populus tremuloides</i>
Shrub	<i>Betula occidentalis</i>
Forb	<i>Equisetum arvense</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Dasiphora fruticosa</i>
Forb	<i>Cirsium scariosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

- *Pseudotsuga menziesii* / *Betula occidentalis* Woodland (CEGL002639)
- *Picea pungens* / *Equisetum arvense* Woodland (CEGL000389)

#### SYNONYMY:

- Conifer/*Equisetum arvense* community type (Padgett et al. 1989) B

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G2.

**Global Classification Comments:** Classification is based on 7 quantitative plots. Two closely related communities include *Pseudotsuga menziesii* / *Betula occidentalis* Woodland (CEGL002639), which lacks *Picea pungens* and *Picea pungens* / *Equisetum arvense* Woodland (CEGL000389), where the shrub layer is sparse and does not have significant cover of *Betula occidentalis*. The conifer/*Equisetum arvense* community type (Padgett et al. 1989) has *Picea pungens* and *Betula occidentalis*, but not consistently.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Picea pungens* / *Betula occidentalis* Woodland is found in a drainage west of the Visitor Center, at the bridge crossing for a footpath (approximately 8365 feet elevation), and also in two mesic drainages in the southeast corner of the monument (approximately 8800 feet elevation and 8900 feet elevation).

**Global Range:** This plant association is known from the central portion of the southern Rockies eastern slope in Colorado and is expected to occur throughout the southern Rocky Mountains in Colorado and probably New Mexico.

**Nations:** US

**States/Provinces:** CO NM?

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 6, 93

**Classification Confidence:** 1 **Identifier:** CEGL002637

**REFERENCES:** Burns and Honkala 1990a, Hansen et al. 1988, Johnston 1987, Kittel et al. 1997, Kittel et al. 1999, Manning and Padgett 1995, Padgett et al. 1989

## II.B.2.N.b. Temporarily flooded cold-deciduous woodland

### II.B.2.N.b. POPULUS BALSAMIFERA TEMPORARILY FLOODED WOODLAND ALLIANCE Balsam Poplar Temporarily Flooded Woodland Alliance

#### POPULUS BALSAMIFERA WOODLAND

##### Balsam Poplar Woodland

#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This temporarily flooded woodland occupies a reach of an unnamed, perennial drainage of only 2% slope. It occupies the stream channel on a small gravel deposit or bar, and both banks for nearly 0.5 km. This drainage is incised up to three meters, which may expose/deposit the substrate necessary for balsam poplar to root sprout and spread.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This type was sampled near the older part of the stand. Consequently the tree height for balsam poplar approached 20 m, the diameters averaged approximately 15 cm, and the largest diameter recorded was 24.4 cm. The largest tree within the plot was a Colorado blue spruce that was only approximately 20 m tall due to crown die-back, but was 73.1 cm in diameter. Tree canopy cover was approximately 75%, with 39 trees over 10 cm dbh present in a 400 m<sup>2</sup> plot. Foliar cover provided by the shrub layer was approximately 40% for the stand, with *Populus balsamifera*, *Dasiphora fruticosa*, *Salix monticola*, and *Salix lucida* the more common shrubs present. Graminoids provided less than 5% foliar cover, most of this from *Carex aquatilis*, *Carex nebrascensis*, and the exotic *Bromus inermis*. Forbs also provided less than 5% foliar cover; the most common were *Heracleum maximum* and *Equisetum arvense*. The balsam poplar stand was extremely species-rich with 41 species recorded. Ground cover was predominantly herbaceous and woody litter (approximately 40% and 50%, respectively), and surface water from the streambed (approximately 5%).

The balsam poplar stand is very linear but may approach the minimum mapping unit for the project. This stand of balsam poplar will resemble quaking aspen in terms of the aerial photo signature presented. This signature is dark green to black on true color and light pink to red on CIR.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus balsamifera</i>
Shrub	<i>Populus balsamifera</i> , <i>Alnus incana</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Carex aquatilis</i> , <i>Carex nebrascensis</i> , <i>Bromus inermis</i>
Forb	<i>Heracleum maximum</i> , <i>Mertensia ciliata</i> , <i>Equisetum arvense</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Not applicable.	

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Populus balsamifera</i> , <i>Picea pungens</i>
Shrub	<i>Alnus incana</i> , <i>Salix monticola</i> , <i>Dasiphora fruticosa</i>

Graminoid *Carex aquatilis, Carex nebrascensis, Bromus inermis*  
Forb *Heracleum maximum, Mertensia ciliata, Equisetum arvense*

**Global**  
**Stratum** **Species**  
Not applicable.

#### OTHER NOTEWORTHY SPECIES

**Florissant Fossil Beds NM**  
**Stratum** **Species**  
None.

**Global**  
**Stratum** **Species**

**GLOBAL SIMILAR ASSOCIATIONS:** Not applicable.

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G?.

**Global Classification Comments:** Not applicable.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Only one stand of balsam poplar was observed and sampled on the monument. This stand occupies the drainage south of the footpath and east of the bridge comprising the trail in the northeastern portion of the monument.

**Global Range:** Not applicable.

**Nations:** Unknown  
**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 74  
**Classification Confidence:** **Identifier:**  
**REFERENCES:**

## III. SHRUBLAND

### III.B.2.N.a. Temperate cold-deciduous shrubland

#### III.B.2.N.a.3. CERCOCARPUS MONTANUS SHRUBLAND ALLIANCE

Mountain-mahogany Shrubland Alliance

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#### CERCOCARPUS MONTANUS / MUHLENBERGIA MONTANA SHRUBLAND

Mountain-mahogany / Mountain Muhly Shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This shrubland occupies gravelly substrate and rocky sites on the dry, upper slopes of hills and ridges. These slopes are typically oriented between approximately 125° and 190°, although a few ridges are more westerly trending. The slopes are steep, from 7-22% and are rapidly drained. *Cercocarpus montanus* shrubs are scattered on these sites, e.g., the canopies rarely overlap, unlike very dense stands that grow at lower elevations in Colorado and nearby states. The gravelly substrate, resulting from the weathering of Pikes Peak granite bedrock, also supported stands of *Yucca glauca* dwarf-shrubland, and sparse woodlands dominated by ponderosa pine and rarely Douglas-fir.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Cercocarpus montanus* is the dominant shrub, along with a few *Ribes cereum* on most sites. Since the type occupies canopy breaks or is occasionally invaded by ponderosa pine trees, it is not unusual to have some foliar cover provided by tree canopies. Ponderosa pine trees associated with mountain-mahogany stands usually show stress, often in the form of mistletoe infestations, short stature, dead branches, etc. In addition, many of the stands are relatively sparse in the shrub layer and are actually dominated by graminoids, particularly *Muhlenbergia montana*, *Festuca arizonica*, and *Bouteloua gracilis*. Total vegetative cover for *Cercocarpus montanus* stands was estimated from 40–70%, dependent on the amount of understory herbaceous growth. Mountain-mahogany and wax currant shrubs are typically from 1–2 m tall and provide foliar cover ranging from 10–30%. Dwarf-shrubs, typically *Yucca glauca*, *Artemisia frigida*, and young *Cercocarpus montanus*, are present, but usually provide less than 5% foliar cover. Graminoids typically provide the dominant foliar cover in a site (from 20–45%), particularly *Muhlenbergia montana*, *Festuca arizonica*, and *Bouteloua gracilis*. Other graminoids observed in mountain-mahogany shrublands included *Muhlenbergia filiculmis*, *Carex inops*, *Blepharoneuron tricholepis*, *Koeleria macrantha*, and *Elymus elymoides*. Forbs rarely contribute greater than 5% foliar cover, and the more common species include *Chenopodium leptophyllum*, *Euphorbia spathulata* (= *Tithymalus montanus*), *Ipomopsis aggregata*, *Cryptantha thyrsoiflora*, *Hymenoxys richardsonii*, *Lithospermum multiflorum*, and *Grindelia subalpina*. Ground cover varies from site to site, i.e., those with smaller amounts of herbaceous cover have from 40–90% bare ground and small rocks (mostly granite gravel), while other sites may have litter values from approximately 10–35%. One stand sampled contained approximately 70% ground cover by herbaceous litter, predominantly from ponderosa pine needles and mast.

These stands are readily observable on true color and CIR photographs, due largely to the size of the shrubs. Many stands are less than the minimum mapping unit, and the more sparse stands may actually be mapped as herbaceous types. On some slopes the stands of mountain-mahogany intermix with stands of bunch grasses and sparse ponderosa pine woodland, which may require delineation as a complex.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Tree	<i>Pinus ponderosa</i>
Shrub	<i>Cercocarpus montanus</i> , <i>Ribes cereum</i>
Dwarf-shrub	<i>Yucca glauca</i> , <i>Artemisia frigida</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Festuca arizonica</i> , <i>Bouteloua gracilis</i>
Forb	<i>Hymenoxys richardsonii</i> , <i>Grindelia subalpina</i>

##### Global Stratum

##### Species

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Cercocarpus montanus</i> , <i>Ribes cereum</i>
Dwarf-shrub	<i>Yucca glauca</i> , <i>Artemisia frigida</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Festuca arizonica</i> , <i>Bouteloua gracilis</i>
Forb	<i>Allium cernuum</i> , <i>Hymenoxys richardsonii</i> , <i>Grindelia subalpina</i> , <i>Lithospermum multiflorum</i>

##### Global Stratum

##### Species

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Forb	<i>Pediocactus simpsonii</i>

**Global  
Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** Not applicable.

**Global Classification Comments:** Not applicable.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Cercocarpus montanus* / *Muhlenbergia montana* Shrubland occupies southern, eastern, and western exposures on the upper slopes of hills and ridges at mid and higher elevations throughout the monument. Often these stands occur within canopy breaks among ponderosa pine woodland stands of the same exposures. One unusual mountain-mahogany stand occurs among Douglas-fir, west of the Visitor Center.

**Global Range:** Not applicable.

**Nations:** US

**States/Provinces:**

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 5, 85, 96, 97

**Classification Confidence:** 3    **Identifier:** To be determined

**REFERENCES:**

**III.B.2.N.a.26. PRUNUS VIRGINIANA SHRUBLAND ALLIANCE**  
Choke Cherry Shrubland Alliance

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**PRUNUS VIRGINIANA - (PRUNUS AMERICANA) SHRUBLAND**

Choke Cherry - (American Plum) Shrubland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This community has a wide distribution, being reported from states primarily in the northwestern United States, including the northwestern Great Plains, but also in Nevada. In Colorado, this riparian shrubland occurs as small pockets on higher terraces or as narrow bands along the high-water mark of steep banks and incised channels. It can also grow at the base of cliffs adjacent to rivers and streams where it forms impenetrable thickets. Stands have a dense, medium-tall (1.5-2 m) shrub canopy that is almost impossible to walk through. This vegetation is dominated by *Prunus virginiana* and grows at the interface between the riparian areas and the adjacent upland.

At Wind Cave National Park in South Dakota, this type is characterized by moderate to dense shrub cover, typically in the 25-75% range. Shrub cover is generally greater in drainage bottoms and on lowermost slopes, and less on slopes. *Prunus virginiana* may be the dominant shrub species, but often other species are codominant or dominant, especially on slopes, including *Rhus trilobata*, *Amorpha canescens*, *Symphoricarpos occidentalis*, and *Toxicodendron pubescens*. Stands dominated by *Prunus americana* may be a variant of this type. In drainage bottom situations, herbaceous cover is usually sparse, less than 10%. On slopes, the shrubs typically occur in some grassland type, and graminoid cover can be greater than 75%.

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This shrubland is unusual and is known for only one site within the monument as a pure stand. At two other sites it is codominant or subdominant to *Ribes cereum*. For all stands, however, outcrops of rhyolite in the form of plate-like rubble provide the substrate. These outcrops appear more moist than the adjacent gravels derived from eroding Pikes Peak granite and are steep (28% slope) with rapid drainage.

**Global Environment:** This association grows at the interface between the riparian areas and the adjacent upland. Stands usually occur as small pockets on higher terraces or as narrow bands along the high water mark of steep banks and incised channels. It can also grow at the base of cliffs adjacent to rivers and streams where it forms impenetrable thickets (CONHP pers. comm. 1998). In southwestern South Dakota, stands are found in a variety of habitats. Slope varies from flat to very steep, with variable aspect. Stands are commonly found in the bottoms of draws and drainages. This type also occurs associated with rock outcrops (H. Marriott pers. comm. 1999, Von Loh et al. 1999).

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** The rhyolite outcrops and thus the stands of this shrubland are small, covering only 100–200 m<sup>2</sup>. The individual shrubs are relatively short, averaging from 1–2 m in height. Within these small chokecherry stands, foliar cover of *Prunus virginiana* is approximately 40% in the densest stand to as little as 5% in a stand codominated by *Ribes cereum*. All stands averaged approximately 55% foliar cover, with approximately 45–50% of this cover provided by shrubs, e.g., *Prunus virginiana*, *Ribes cereum*, *Dasiphora fruticosa*, and *Rubus deliciosus*. Common grass species within the stands were *Bouteloua gracilis* and *Muhlenbergia montana* (with foliar cover values from 5–10%), and the common forbs included *Grindelia subalpina*, *Galium boreale*, and *Allium cernuum* (with foliar cover values less than 5%). Ground cover in these small stands was predominantly large rocks (65–95% cover) and litter (15–30% cover). The large rocks were flat plates of rhyolite, a volcanic rock rarely outcropping in the area.

These small stands appear as light spots with pebbly dots on true color aerial photographs. They are below the minimum mapping unit; however, they are unique for the monument.

**Global Vegetation:** In Colorado, this community type is a medium-height (1.5–2 m) shrubland with dense vegetation that is almost impossible to walk through (CONHP pers. comm. 1998). In southwestern South Dakota, this type is characterized by moderate to dense shrub cover, typically in the 25–75% range. Shrub cover is generally greater in drainage bottoms and on lowermost slopes, and less on slopes. *Prunus virginiana* may be the dominant shrub species, but often other species are codominant or dominant, especially on slopes, including *Prunus americana*, *Rhus trilobata*, *Amorpha canescens*, *Symphoricarpos occidentalis* and *Toxicodendron pubescens*. In drainage bottom situations, herbaceous cover is usually sparse, less than 10%. On slopes, the shrubs typically occur in some grassland type, and graminoid cover can be greater than 75%.

**Global Dynamics:** Some stands on slopes are the result of recent fire that killed the overlying canopy, converting *Pinus ponderosa* / *Prunus virginiana* Forest (CEGL000192) to this *Prunus virginiana* shrubland type.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Prunus virginiana</i> , <i>Dasiphora fruticosa</i> , <i>Ribes cereum</i>
Graminoid	<i>Bouteloua gracilis</i> , <i>Muhlenbergia montana</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Prunus virginiana</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Prunus virginiana</i> , <i>Ribes cereum</i>
Graminoid	<i>Bouteloua gracilis</i> , <i>Muhlenbergia montana</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Prunus virginiana</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Prunus americana</i> , <i>Symphoricarpos occidentalis</i>
Graminoid	<i>Pascopyrum smithii</i> , <i>Poa pratensis</i>



**GLOBAL SIMILAR ASSOCIATIONS:**

*Fraxinus pennsylvanica* - *Ulmus americana* / *Prunus virginiana* Woodland (CEGL000643)

**SYNONYMY:**

- DRISCOLL FORMATION CODE:III.B.3.a. (Driscoll et al. 1984) B
- *Prunus virginiana* (Bourgeron and Engelking 1994) =
- *Prunus virginiana* community type (Hansen et al. 1995) =
- *Prunus virginiana* Dominance Type (Jones and Walford 1995) =
- *Prunus virginiana* / *Rosa woodsii* community type (Manning and Padgett 1995) F

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G4Q.

**Global Classification Comments:** The *Prunus virginiana* / *Rosa woodsii* (common chokecherry / wild rose) community type (Manning and Padgett 1995) is closely related but does not include any *Symphoricarpos occidentalis*.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Prunus virginiana* dominated one stand on a west-facing slope of Grape Creek southeast of the maintenance shop. This stand and two small south- and west-facing stands west of the Hornbek Homestead, where *Prunus virginiana* is codominant with *Ribes cereum*, occupy steep slopes of plate-like rhyolite outcrops.

**Global Range:** This shrubland is found primarily in the northern Great Plains and northwestern Rocky Mountain regions of the United States, but may extend into the Great Basin.

**Nations:** US

**States/Provinces:** CO ID MT NV? OR SD WA WY

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plot 44

**Classification Confidence:** 2 **Identifier:** CEGL001108

**REFERENCES:** Bourgeron and Engelking 1994, Caicco and Wellner 1983n, Copeland 1980a, Driscoll et al. 1984, Evans 1989a, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999, Manning and Padgett 1995, Von Loh et al. 1999

## III.B.2.N.d. Temporarily flooded cold-deciduous shrubland

### III.B.2.N.d.9. ALNUS INCANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Speckled Alder Temporarily Flooded Shrubland Alliance

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**ALNUS INCANA / MESIC GRAMINOIDS SHRUBLAND**

Speckled Alder / Mesic Graminoids Shrubland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This shrubland association is a widespread community of limited extent in the western states of Idaho, Colorado, Utah, Wyoming, and Nevada. Stands occur in narrow to moderately wide floodplains on stream benches, in association with abandoned meanders, on islands and pointbars, and on hillside seeps. These shrublands are characterized by stands of medium-tall and tall, deciduous shrubs and a thick herbaceous undergrowth of wetland-indicator grasses, and little to no overstory tree canopy. Total shrub cover is usually over 50% and is dominated by *Alnus incana*, the diagnostic shrub. Other shrubs includes *Salix* spp., *Betula occidentalis*, and *Cornus sericea*. The understory of undisturbed stands has a dense herbaceous cover including *Glyceria* spp., *Calamagrostis canadensis*, *Elymus glaucus*, *Carex* spp., and *Equisetum* spp. Heavily disturbed stands have abundant non-native grasses. In Nevada, Utah, southeastern Idaho, and Wyoming, this type is considered a grazing-induced community derived from *Alnus incana* / Mesic Forbs Shrubland (CEGL001147). However, several stands in Colorado are undisturbed and the undergrowth is dominated by native graminoid cover.

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This shrubland occupies two small, west-flowing drainages at moderate elevations in the monument. The drainages differ in that the northernmost drainage and upper southernmost are low-gradient and support stands of sedge and willow, while the lower portion of the southernmost drainage is steep, narrow, and incising (approximately 4–5 m deep through loose gravel alluvium). The stand of *Alnus incana* located in the incised drainage portion is showing stress from drought and fire, e.g., stunted growth, many dead stems/shrub bases, and many new root sprouts, while those of more mesic sites appear healthy. The more stressed stand also exhibited chewing and other bark damage from elk, much like that observed in quaking aspen stands.

**Global Environment:** Stands occur in narrow to moderately wide floodplains on stream benches, in association with abandoned meanders, on islands and pointbars, and on hillside seeps. *Alnus incana* tends to dominate narrow streambanks where stream gradients are relatively steep, or on more cobbly substrates than their willow neighbors in broad floodplain settings. Stream channels can be steep and straight to highly sinuous (Rosgen's Channel Type: A3, A4, F3) or moderately steep and sinuous (Rosgen's Channel Type: B2, B3, B4, B6) (Rosgen 1996). Where this association occurs on point bars, stream channels are low gradient (<1% gradient) and highly sinuous (Rosgen's Channel Type: C5) (Rosgen 1996). Soils are mostly coarse alluvium, but characteristically have silt loams or sandy clay loams at the surface with a high percentage of organic matter. Soils are shallow to moderately deep, 15–30 inches (35–62 cm), and become increasingly skeletal with depth. Most profiles have 10–50% mottles at 7–10 inches (18–25 cm) depth. One profile had gleyed, mineral soils indicating saturated conditions.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This shrubland occurs in small patches and linear stands (stringers along drainages) that are less than 15 m wide and from 25–75 m in length. The stands are associated with species of willow (*Salix exigua*, *Salix monticola*, and *Salix ligulifolia*) and water birch (*Betula occidentalis*) providing a total shrub cover of approximately 35–45%. The shrubs may be quite tall, from 5–15 m depending on the stand health and site location. Stands located on mesic sites with sedge species in the understory appeared healthier and more robust than those of the drier, incised drainage reach. The oldest individual *Alnus incana* stems were associated with the upper portion of the driest site, in association with a quaking aspen stand, and trunk diameters up to 16.5 cm were recorded for the large alders. Graminoids associated with *Alnus incana* stands were tall, from 1–2 m and provided from 40–50% foliar cover. The most common graminoid species present included *Carex nebrascensis*, *Carex utriculata*, *Carex aquatilis*, and *Juncus balticus* and the exotics *Poa pratensis* and *Phalaris arundinacea*. Forbs associated with *Alnus incana* stands also ranged from 1–2 m in height and contributed approximately 20% foliar cover. The most common forbs present included *Heracleum maximum*, *Mertensia ciliata*, *Mentha arvensis*, and *Cirsium scariosum* (= *Cirsium tioganum*). Ground cover consisted of predominantly herbaceous litter (60–90%), which was very thick (up to 10 cm at some locations) and litter in the form of wood (approximately 8–20%).

The patches and stands of this shrubland are less than the project minimum mapping unit and are typically associated with willow shrubs. The signature of this association is the same as that for willow stands, i.e., black to dark green for true color and bright pink to red for CIR.

**Global Vegetation:** These shrublands are characterized by stands of medium-tall and tall, deciduous shrubs and a thick herbaceous undergrowth of wetland-indicator grasses, and little to no overstory tree canopy. Total shrub cover is usually over 50% and is dominated by *Alnus incana*, the diagnostic shrub. *Alnus incana ssp. tenuifolia* dominates the upper canopy with 10–90% cover. Other shrubs occasionally present include *Salix exigua*, *Salix monticola*, *Rubus deliciosus*, *Salix bebbiana*, *Salix drummondiana*, *Rosa woodsii*, and *Cornus sericea*. Occasionally, trees may be scattered throughout the shrubland, or occur along one edge. Tree species include *Populus deltoides ssp. monilifera* and *Salix fragilis*.

The undergrowth is a thick carpet of grasses. Native graminoids include *Calamagrostis canadensis*, *Carex utriculata*, *Glyceria striata*, *Carex aquatilis*, *Carex lanuginosa*, and *Festuca rubra*. Heavily disturbed stands are dominated by introduced, non-native grasses including *Poa pratensis*, *Agrostis stolonifera*, and *Bromus inermis*. Forb cover is usually low relative to the amount of graminoid cover, but can include a high variety of species, including *Mertensia ciliata*, *Mentha arvensis*, *Cardamine cordifolia*, and *Caltha leptosepala*.

**Global Dynamics:** *Alnus incana ssp. tenuifolia* is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining (Viereck 1970, Van Cleve et al. 1971, Chapin et al. 1994, Hansen et al. 1989). After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop (Padgett et al. 1989).

*Alnus incana* is shade-intolerant (Viereck 1970, Chapin et al. 1994), and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy. *Alnus incana* has been observed on high-gradient streams and is thought to require well-aerated water (Hansen et al. 1988b, Padgett et al. 1989).

Undisturbed *Alnus incana* stands may become dominated by *Salix* (willow) species or conifer stands (Hansen et al. 1989). In Alaska, thick stands of alders inhibit succession by competing with spruce for nutrients and light (Chapin et al. 1994). In Utah, *Acer negundo* (box-elder) often becomes the dominant canopy species on more xeric sites (Padgett et al. 1989).

*Alnus incana* fixes atmospheric nitrogen through a symbiotic relationship with the bacteria *Frankenia* and increases the ecosystem nitrogen supply with the deposition of nitrogen-rich leaf litter (Binkley 1986). The annual input of nitrogen to soils from alder species ranges from 10 to 150 times the amount deposited by atmospheric precipitation alone (Binkley 1986, Bowman and Steltzer *in press*). Nitrogen rich detritus is an important source of nutrients for the aquatic ecosystem as well.

In Nevada, Utah, southeastern Idaho, Montana, and Wyoming, the *Alnus incana*/mesic graminoid type is considered a grazing-induced community, derived from the *Alnus incana*/mesic forb plant association (Padgett et al. 1989, Manning and Padgett 1995, Jones 1992c). In Colorado, most stands of this plant association appear to be disturbed by improper grazing and have an abundance of non-native graminoid species. A few stands, however, appear undisturbed and have an undergrowth dominated by native grasses.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Alnus incana</i>
Graminoid	<i>Carex nebrascensis</i> , <i>Phalaris arundinacea</i>
Forb	<i>Cirsium scariosum</i> , <i>Iris missouriensis</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Alnus incana</i>
Graminoid	<i>Calamagrostis canadensis</i> , <i>Carex</i> spp., and <i>Equisetum</i> spp.
Forb	<i>Mertensia ciliata</i> , <i>Achillea millefolium</i> , <i>Taraxacum officinale</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Alnus incana</i> , <i>Salix monticola</i> , <i>Salix exigua</i>
Graminoid	<i>Carex nebrascensis</i> , <i>Phalaris arundinacea</i> , <i>Poa pratensis</i>
Forb	<i>Mertensia ciliata</i> , <i>Heracleum maximum</i> , <i>Cirsium scariosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Alnus incana</i> ,
Graminoid	<i>Calamagrostis canadensis</i> , <i>Carex</i> spp., and <i>Equisetum</i> spp.
Forb	<i>Mertensia ciliata</i> , <i>Achillea millefolium</i> , <i>Taraxacum officinale</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global</u>	<u>Stratum</u>	<u>Species</u>

#### GLOBAL SIMILAR ASSOCIATIONS:

##### SYNONYMY:

- DRISCOLL FORMATION CODE:III.B.3.c. (Driscoll et al. 1984) B
- *Alnus incana*/Mesic graminoid (Bourgeron and Engelking 1994) =
- *Alnus incana* / Mesic forbs (Padgett et al. 1989). a grazing-induced sere.
- *Alnus incana* / Mesic forbs (Manning and Padgett 1995). a grazing-induced sere.
- *Alnus incana* / *Glyceria elata*. Oregon.
- *Alnus incana* / *Calamagrostis canadensis*. Oregon.

- *Alnus incana* / *Scirpus microcarpus*. Oregon.
- *Alnus incana* / *Carex amplifolia*. Oregon.
- *Alnus incana* / *Carex pellita*. Oregon.

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G3.

**Global Classification Comments:** Classification is based on data collected from throughout the range of the association. Some classifications have considered this a grazing-induced sere of the *Alnus incana* / Mesic Forbs Shrubland (CEGL001147) (Padgett et al. 1989, Manning and Padgett 1995). High-quality stands with a native understory are uncommon, but are reported in Colorado and Idaho, and are suspected in Wyoming. In Oregon, five *Alnus incana* plant associations (*Alnus incana* / *Glyceria elata*, *Alnus incana* / *Calamagrostis canadensis*, *Alnus incana* / *Scirpus microcarpus*, *Alnus incana* / *Carex amplifolia*, and *Alnus incana* / *Carex pellita*) were described and one or more may belong in this association.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Stands of *Alnus incana* / Mesic Graminoids Shrubland occur only in two minor drainages tributary to Grape Creek. Both drainages are on the eastern portion of the monument above 8500 feet elevation (8520–8550 feet) in nearly flat to moderately steep topography (1–12%). As a result, the stands are poorly drained to moderately well-drained. The northernmost drainage lies adjacent to the trail running along the northeastern monument boundary; the southernmost is near the southeastern monument boundary.

**Global Range:** This plant association is a minor riparian type in Idaho, Colorado, Utah, Wyoming, and Nevada.

**Nations:** US

**States/Provinces:** CO ID NV UT WY

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 17, 80

**Classification Confidence:** 2 **Identifier:** CEGL001148

**REFERENCES:** Binkley 1986, Bourgeron and Engelking 1994, Bowman and Steltzer n.d., Chapin et al. 1994, Driscoll et al. 1984, Hansen et al. 1988b Hansen et al. 1989, Jones 1992b, Jones 1992c, Kettler and McMullen 1996, Kittel et al. 1996, Kittel et al. 1999, Manning and Padgett 1995, Padgett et al. 1989, Richard et al. 1996, Rosgen 1996, Van Cleve et al. 1971, Viereck 1970

### III.B.2.N.d.17. DASIPHORA FRUTICOSA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Shrubby-cinquefoil Temporarily Flooded Shrubland Alliance

#### ALLIANCE CONCEPT

**Summary:** This shrubland alliance is highly variable, occupying various landforms in the foothills, montane, and subalpine regions in the Rocky Mountain region. Sites include glacial depressions, terraces along meandering streams, slopes near springs and seeps, steep scree slopes, or broad mountain meadows. Typically, stands occur on broad, gently sloping valley bottoms and floodplains or along the drier edges of isolated wetlands and fens. Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface. The soils are typically sandy loams over sand and gravel layers. Peat accumulation is common in stands located on fens. Soil texture can be fine-textured with occasional mottling and gleying. This alliance is dominated by *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*). Associates include *Artemisia cana* and *Deschampsia caespitosa* and *Trifolium longipes* on wetter sites. Other graminoids present in the wetter sites may include *Poa secunda*, *Festuca rubra*, *Carex aquatilis*, *Carex buxbaumii*, *Carex microptera*, *Carex pachystachya*, *Juncus balticus*, and *Muhlenbergia filiformis*. The drier sites typically are composed of a dense graminoid layer that includes *Festuca idahoensis*, *Festuca campestris*, *Schizachyrium scoparium*, and *Andropogon gerardii*. Diagnostic of this alliance is the dominance of *Dasiphora fruticosa* ssp. *floribunda* in a shrub layer with over 25% cover.

**Environment:** Plant associations within this alliance are highly variable, occupying various landforms in the foothills, montane, and subalpine regions. They range in elevation from 860 m in Montana to 3000 m in Colorado. These communities can occupy sites adjacent to glacial depressions, terraces along meandering streams, slopes near springs and seeps, steep scree slopes, or broad mountain meadows. Typically, stands occur on broad, gently sloping valley bottoms and floodplains or along the drier edges of isolated wetlands and fens. Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface.

Parent materials for sites supporting stands of this alliance are either alluvial-glacial or organic. The soils are typically sandy loams over sand and gravel layers. Peat accumulation is common in stands located on fens. Soil texture can be fine-textured with occasional mottling and gleying. *Salix wolfii*, *Salix boothii*, or *Betula nana* (= *Betula glandulosa*) communities can be in the adjacent riparian areas.

**Vegetation:** Plant associations within this alliance are classified as temporarily flooded, cold-deciduous shrublands. *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) dominates the overstory with a range of 10-60% cover in all stands. *Artemisia cana* and *Deschampsia caespitosa* typically occur with *Dasiphora fruticosa* ssp. *floribunda* in wetter sites. Other graminoids present in the wetter sites can include *Poa secunda*, *Festuca rubra*, *Carex buxbaumii*, *Carex microptera*, *Carex pachystachya*, *Muhlenbergia filiformis*, and *Juncus balticus*. Colorado stands in excellent condition (i.e., not grazing-induced) have high cover of *Carex aquatilis* and *Trifolium longipes*.

The drier sites typically are composed of a dense graminoid layer, up to 75% cover, that includes *Festuca idahoensis*, *Festuca campestris*, *Schizachyrium scoparium*, and *Andropogon gerardii*. *Dasiphora fruticosa* ssp. *floribunda* is a common understory shrub for associations dominated by the following montane trees *Pinus pungens* or *Pinus flexilis*. Riparian stands that include *Dasiphora fruticosa* ssp. *floribunda* as an understory can include *Betula occidentalis* or *Betula pumila*. In the Pacific Northwest, common overstory species can include *Larix laricina*, *Acer rubrum*, or *Myrica gale*.

**Dynamics:** *Dasiphora fruticosa* ssp. *floribunda* is an opportunistic species and as such occurs on a variety of habitats. Many of the communities dominated by this species appear to be controlled by disturbance. Komarkova (1986) reports stands on subalpine scree slopes that have relatively rapidly moving fine materials or snow.

Heavily grazed sites may support *Dasiphora*-dominated communities as well (Komarkova 1986, Padgett et al. 1989). *Dasiphora fruticosa* ssp. *floribunda* / *Deschampsia caespitosa* Shrubland (CEGL001107) in this alliance is a mid-seral stage of secondary succession as a result of heavy grazing. With improper grazing, *Dasiphora fruticosa* ssp. *floribunda* will increase in abundance because it is unpalatable to livestock. Other species that increase with grazing in this association are *Poa pratensis*, *Juncus balticus*, and *Taraxacum officinale* (Padgett et al. 1989). Extended grazing may cause this plant association to convert to a *Dasiphora fruticosa* ssp. *floribunda* / *Poa pratensis* plant association.

**Similar Alliances:**

- DASIPHORA FRUTICOSA SSP. FLORIBUNDA SHRUB HERBACEOUS ALLIANCE (A.1534)

**Similar Alliance Comments:** The *Dasiphora fruticosa* ssp. *floribunda* Shrub Herbaceous Alliance (A.1534) occurs at lower elevations and on drier sites than this alliance.

**SYNONYMY:**

- *Pentaphylloides floribunda* Series (Johnston 1987)

**ALLIANCE DISTRIBUTION**

**Range:** This alliance has been described from scattered locations throughout the Rocky Mountains, from Montana west into Oregon, and south into Nevada, Colorado and New Mexico. *Dasiphora fruticosa* ssp. *floribunda* is widespread throughout North America. It occurs from Alaska east to Newfoundland, Canada, south to California, New Mexico, Iowa, and New Jersey (Welsh et al. 1987). This alliance could potentially occur in the neighboring states of Washington and the higher elevations of Arizona.

**Nations:** CA? US

**States/Provinces:** CO ID MT NM NV OR UT WY

**ALLIANCE SOURCES**

**Authors:** D. CULVER, WCS **Identifier:** A.958

**REFERENCES:** Baker 1980a, Baker 1983a, Crowe and Clausnitzer 1997, Hansen et al. 1991, Hansen et al. 1995, Johnston 1987, Jones 1992b, Kettler and McMullen 1996, Kittel et al. 1999, Komarkova 1986, Lee and Jonkel 1980, Loope 1969, Mutz and Graham 1982, Padgett et al. 1988b, Padgett et al. 1989, Sanderson and March 1996, Welsh et al. 1987, Youngblood et al. 1985a, Youngblood et al. 1985b

**FLORISSANT FOSSIL BEDS NATIONAL MONUMENT STAND DESCRIPTION**

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This shrubland is found along the margins of emergent wetlands growing from saturated soil and other moist soil sites, and *Dasiphora fruticosa* is an understory shrub in mesic forest types. The sites sampled are of low to moderate gradient (from 2–7% slopes), are considered somewhat poorly drained to moderately well-drained, and occur on any aspect if the moisture regime is adequate. These stands probably increased to their present level of density and abundance under past heavy grazing pressure.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Dasiphora fruticosa* is the common shrub of this type, growing along upper wetland margins and in moist drainages, predominantly. This is a zone of mixing or an ecotone between wetland and upland plant associations, therefore *Dasiphora fruticosa* may be associated with obligate wetland species such as *Salix monticola*, *Carex aquatilis*, *Carex utriculata*, or *Juncus balticus*, or drier species such as *Bromus porteri* or *Pascopyrum smithii* and the exotics *Poa pratensis*, *Bromus inermis*, and *Linaria vulgaris*. *Dasiphora fruticosa* is a rounded shrub, less than 1 m in height, and typically provides from 40–65% foliar cover in a stand. *Dasiphora fruticosa* is also a minor component of other mesic sites including willow-dominated wetlands and shaded sites, particularly as understory to *Populus tremuloides* and *Picea pungens*. The associated graminoids are typical of moist to mesic sites, e.g., *Juncus balticus*, *Deschampsia caespitosa*, *Poa pratensis*, *Pascopyrum smithii*, and *Carex utriculata*, and typically contribute from 40–50% foliar cover. Forbs are diverse in this type, but rarely provide more than 10% foliar cover and usually provide less than 5%. The more common forbs present include *Achillea millefolium*, *Cirsium tioganum*, and *Iris missouriensis*. Ground cover varies from 80–100% litter for most sites, to as little as 25% litter in a gravel drainage. Small gravel provided ground cover up to 60% on a site where alluvium was exposed by flows and aggradation in an intermittent drainage.

This type has a characteristic signature on true color aerial photography, a dark green color and pebbly texture. It is more pronounced on CIR photography with an associated maroon color and pebbly texture.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Dasiphora fruticosa</i>
Graminoid	<i>Juncus balticus</i> , <i>Poa pratensis</i>
Forb	<i>Iris missouriensis</i> , <i>Achillea millefolium</i> , <i>Cirsium tioganum</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Dasiphora fruticosa</i>
Graminoid	<i>Juncus balticus</i>
Forb	<i>Iris missouriensis</i> , <i>Achillea millefolium</i> , <i>Cirsium tioganum</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Forb	<i>Linaria vulgaris</i>

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Dasiphora fruticosa* Shrubland is limited to drainage bottoms, moist swale bottoms, margins of livestock watering ponds, quaking aspen woodland understory, and the perimeter of emergent wetland types. The type is located throughout the monument at low to mid-elevations in moist-shaded to saturated conditions.

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 14, 32, 39

### III.B.2.N.d.15. ELAEAGNUS COMMUTATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

American Silverberry Temporarily Flooded Shrubland Alliance

#### ELAEAGNUS COMMUTATA SHRUBLAND

American Silverberry Shrubland

#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This shrubland is unusual and is known from only one site with a steep, rapidly drained slope (37%) and northwestern, western, and southeastern aspects because it wraps around the head of a ridge at midslope. This slope contains a band of outcropping volcanic material (welded tuff), volcanic talus, and small pieces of shale surrounded by Pikes Peak granite bedrock above and granite alluvium in the lower, adjacent drainage.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Elaeagnus commutata* shrubs are of relatively short stature, between 1 and 2 m tall, and sparse, providing approximately 20% vegetative cover. The silverberry association lies between *Pinus ponderosa* / *Cercocarpus montanus* Woodland (CEGL000851) upslope and *Festuca arizonica* - *Muhlenbergia montana* Herbaceous Vegetation (CEGL001606) that occupies the alluvial deposits of the adjacent valley side. The secondary species therefore represent the dominants in adjacent plant associations, with the exception of *Apocynum androsaemifolium*. It is unknown if this stand is a relict or if it is a relatively new introduction for the area. Vegetative cover for this stand totals approximately 50% and consists of approximately 5% for *Pinus ponderosa* trees, 25% for shrubs, including *Elaeagnus commutata* and *Ribes cereum*, and 20% for herbaceous species, particularly *Festuca arizonica*, *Bouteloua gracilis*, *Muhlenbergia montana*, *Grindelia subalpina*, *Galium boreale*, and *Allium cernuum*. The plot was diverse, e.g., 38 species were observed in a 400 m<sup>2</sup> plot. Volcanic outcrops are unusual for the monument, and the vegetation types supported are quite different than the more widespread associations occupying Pikes Peak granite exposures. Ground cover for this silverberry stand consists of approximately 55% bare soil, 40% litter, and 5% exposed volcanic rock and large boulders.

Only one stand of silverberry is extant in the monument, and is below the minimum mapping unit for the project. The aerial photo signature is light pink to white on CIR, because of the reflectance from exposed rocks. For true color aerial photography, the signature is light tan.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

##### Stratum

##### Species

Shrub	<i>Elaeagnus commutata</i> , <i>Ribes cereum</i>
Dwarf-shrub	<i>Artemisia frigida</i> , <i>Apocynum androsaemifolium</i>
Graminoid	<i>Festuca arizonica</i>
Forb	<i>Grindelia subalpina</i> , <i>Galium boreale</i> , <i>Allium cernuum</i>

##### Global

##### Stratum

##### Species

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

##### Stratum

##### Species

Shrub	<i>Elaeagnus commutata</i> , <i>Ribes cereum</i>
Dwarf-shrub	<i>Artemisia frigida</i> , <i>Apocynum androsaemifolium</i>

Graminoid	<i>Festuca arizonica, Bouteloua gracilis, Muhlenbergia montana</i>
Forb	<i>Grindelia subalpina, Galium boreale, Allium cernuum</i>

<b>Global</b>	
<b><u>Stratum</u></b>	<b><u>Species</u></b>

#### OTHER NOTEWORTHY SPECIES

Florissant Fossil Beds NM

<b>Global</b>	
<b><u>Stratum</u></b>	<b><u>Species</u></b>

#### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** Not applicable.

**Global Classification Comments:** Not applicable.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Only one stand is present, south of Lower Twin Rock Road on a west-facing slope adjacent to a tributary to Grape Creek.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:**

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 15

**Classification Confidence:** 3 **Identifier:**

**REFERENCES:**

### III.B.2.N.d.6. SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance

#### SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND

Coyote Willow Temporarily Flooded Shrubland

#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This willow shrubland community is found throughout the northwestern United States and Great Plains. This type is an early successional stage that occurs along rivers and streams at lower elevations, on recently flooded riparian areas, and in moist swales and ditches that are frequently disturbed. Stands occur most commonly on alluvial sand, but silt, clay, or gravel may also be present. *Salix exigua* is the dominant canopy species (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). It can form dense stands up to 4 m tall, but there are often patches where the shrub layer is absent. Seedlings and small saplings of *Populus deltoides* and *Salix amygdaloides* may be present. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Species present include *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Triglochin maritima*, and *Xanthium strumarium*. The composition of this community, especially the herbaceous layer, varies from year to year with succession or renewed disturbance.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This temporarily flooded shrubland is distributed along Grape Creek for only a short distance of approximately one km and at the lowest monument elevations (between 8150-8225 feet). Sandbar willow stands occupy a nearly flat gradient of 1–3% and are poorly drained. They are confined to the gravel and sand substrate of the creek and expand



upstream, only because beaver ponds have been constructed in the drainage bottom. This type rapidly transitions to the *Salix monticola* temporarily flooded shrublands where beaver ponds are actively maintained and the drainage narrows into a small canyon.

**Global Environment:** This community is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Grape Creek appears to be aggrading due to accumulation of gravelly alluvium and finer sediments in the portion between the northern boundary fenceline and the lower beaver ponds. This probably results from lower velocity flows after passing through the beaver pond area, providing the substrate conducive to the growth of *Salix exigua*. The sandbar willow shrubs near the boundary fenceline are quite tall, approximately 5–8 m, and are reproducing by root sprouts (2–3 m in height). They have shorter stature around the beaver ponds (from 2–4 m tall) likely due to younger growth from root sprouts, resulting from foraging by beaver and drowning of older stems. At both stands sampled, *Salix exigua* provided approximately 50% foliar cover, while *Salix monticola* provided from 5–25% foliar cover, and *Dasiphora fruticosa* consistently provided approximately 3% foliar cover. With the exception of *Juncus balticus* and *Eleocharis palustris* (approximately 2% foliar cover each), most graminoids within the stands sampled are exotics, e.g., *Elymus repens* (= *Elytrigia repens*), *Poa pratensis*, *Phleum pratense*, *Agrostis scabra*, and *Bromus inermis* (in the aggregate, they contribute approximately 5–8% foliar cover). Commonly associated forbs, providing approximately 5–10% foliar cover, included *Heracleum maximum*, *Achillea millefolium*, *Solidago* sp., *Equisetum arvense*, and the exotic *Linaria vulgaris*. Ground cover ranged from 60–80% litter, 5–20% woody litter, 1–10% open water, and the remainder was small gravel. The large amount of woody litter and open water is the result of beaver dam construction and ponded water behind these structures.

This stand probably approaches the minimum mapping unit in size, although it is difficult to tell with certainty because of the long and linear nature. Its aerial photograph signature is identical to other willow associations in the monument, e.g., dark green to nearly black on true color and bright pink on CIR.

**Global Vegetation:** This community is dominated by shrubs generally between 2 and 4 m tall. The most common of these is *Salix exigua* (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). *Salix irrorata* and saplings of *Populus deltoides* or *Salix amygdaloides* are also frequently found in the shrub layer in lower elevation stands. This stratum can have moderate to high stem density in the community as a whole. The species in the shrub layer do not form a closed canopy, allowing significant light to reach the ground layer. There are often patches where the shrub layer is absent. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Older stands and places with less competition from the shrubs have greater herbaceous cover. The composition of the herbaceous layer can vary greatly. Species that are often found in this community are *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Triglochin maritima*, *Xanthium strumarium*, *Juncus balticus*, *Eleocharis palustris*, *Elymus repens* (= *Elytrigia repens*), *Poa pratensis*, *Phleum pratense*, *Agrostis scabra*, *Bromus inermis*, *Heracleum maximum*, *Achillea millefolium*, *Solidago* sp., *Equisetum arvense*, and *Linaria vulgaris*.

**Global Dynamics:** This type originates after flash floods that create new deposits or scour existing alluvial material. This community is a primary or early secondary community and requires floods to create new areas on which it can develop. Once established, without further flooding disturbance and sediment deposition, this community may not exist for more than 10–20 years before it is replaced by a later seral stage.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix exigua</i> , <i>Salix monticola</i>
Graminoid	<i>Juncus balticus</i> , <i>Poa pratensis</i> , <i>Eleocharis palustris</i>
Forb	<i>Heracleum maximum</i> , <i>Achillea millefolium</i> , <i>Linaria vulgaris</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix exigua</i>

### CHARACTERISTIC SPECIES

#### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix exigua</i> , <i>Salix monticola</i>
Graminoid	<i>Juncus balticus</i>
Forb	<i>Heracleum maximum</i>

#### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix exigua</i>

### OTHER NOTEWORTHY SPECIES

#### Florissant Fossil Beds NM

#### Global

<u>Stratum</u>	<u>Species</u>
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### GLOBAL SIMILAR ASSOCIATIONS:

- *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203)--This type may be essentially the same, or this type is a later successional stage.
- *Salix interior* - *Salix eriocephala* Sandbar Shrubland (CEGL005078)--of the Great Lakes states/provinces.

### SYNONYMY:

- DRISCOLL FORMATION CODE:III.B.3.c. (Driscoll et al. 1984) B
- *Salix exigua* (Bourgeron and Engelking 1994) =
- R4B3cI2a. *Salix exigua* (Foti et al. 1994)

### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G5.

**Global Classification Comments:** This type may be an early successional shrubland that develops into *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203), or the two types may be essentially synonymous. This plant association occupies a wide geographic range. The range of this type was reviewed and it was split into eastern, *Salix interior* Temporarily Flooded Shrubland (CEGL008562), and western components. The western stands may all be composed of *Salix exigua* (*sensu stricto*) and Great Plains stands may contain either *Salix exigua*, *Salix interior*, or intermediates of the two willow species, the *Salix interior* being an entirely Great Plains and eastwardly distributed species (Kartesz 1999).

### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Stands of *Salix exigua* Temporarily Flooded Shrubland are present along Grape Creek, in a patchy distribution from the northern boundary fenceline to a series of beaver ponds, approximately 1 km upstream from the boundary. Extensive stands of this type are present north of the monument, along Grape Creek as it meanders across private land, along Twin Creek, and also along the South Platte River west of the town of Florissant. All off-monument stands are heavily grazed.

**Global Range:** This sandbar willow shrubland community is found along rivers and streams at lower elevations throughout the northwestern United States and Great Plains, ranging sporadically from Oklahoma northwest to the Dakotas and Manitoba, and west to Washington. Part of this type's former range in the Great Plains and eastward is actually occupied, at least in part, by *Salix interior* [see *Salix interior* Temporarily Flooded Shrubland (CEGL008562)].

**Nations:** CA US

**States/Provinces:** ID MB MT ND NE OK OR SD WA WY

### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 69, 70

**Classification Confidence:** 1 **Identifier:** CEGL001197

**REFERENCES:** Bellah and Hulbert 1974, Bourgeron and Engelking 1994, Driscoll et al. 1984, Evenden 1990, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998c, Hoagland 2000, Kartesz 1999, Kittel and Lederer 1993, Kovalchik 1987, Phillips 1977, Steinauer 1989, Steinauer and Rolfmeier 2000, Wilson 1970

### III.B.2.N.d.37. SALIX LIGULIFOLIA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Strapleaf Willow Temporarily Flooded Shrubland Alliance

#### SALIX LIGULIFOLIA SHRUBLAND

##### Strapleaf Willow Shrubland

#### ELEMENT CONCEPT

**Summary:** This plant association is a medium to tall (5-15 feet, 1.5-3 m) willow shrubland occurring in saturated areas at montane elevations (6700-10,800 feet) of Colorado. It occurs in the wettest part of the riparian area, usually adjacent to the channel on low point bars, islands, and overflow channels. The higher elevation distribution of *Salix ligulifolia* in Colorado occurs in relatively broad valley bottoms along low terraces and floodplains, and along streambanks of narrower reaches. Soils are saturated sandy loams and clay loams with a high organic matter content in the upper layers. *Salix ligulifolia* is found in mixed stands with other willows such as *Salix monticola*, *Salix geyeriana*, and *Salix drummondiana*. *Salix ligulifolia* is the key diagnostic species, other willows may have equal cover, but in general do not exceed that of *Salix ligulifolia*. The herbaceous undergrowth can be dense in undisturbed stands with *Carex utriculata* (1-40%), *Carex nebrascensis* (1-5%), *Carex lanuginosa* (1-3%), *Juncus balticus* (1-20%), and *Calamagrostis canadensis* (1-27%). Forb cover is generally low. *Salix exigua* - *Salix ligulifolia* Shrubland (CEGL002655) is a closely related association occurring in the Colorado foothills at lower elevations.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** The *Salix ligulifolia* Shrubland is unusual within the monument and was growing along a small, low-gradient (approximately 2% slope) drainage that is tributary to Grape Creek. The floodplain associated with this drainage was saturated to the surface and flowing water approximately one meter wide was present. This stand occurred at approximately 8410 feet in elevation.

**Global Environment:** This association occurs in moderately wide valleys along low terraces and floodplains, and stream banks of narrower reaches. The plant association occurs along reaches with vegetated islands between multiple channels below an active beaver pond (Rosgen's Channel Type: D3), along slightly sinuous broad channels (Rosgen's Channel Type: B2, B4), along more sinuous channels with well-developed floodplains (Rosgen's Channel Type: C4), and along steep narrow gullies (Rosgen's Channel Type: G3) (Rosgen 1996). Soils are saturated sandy loams and clay loams with a high organic matter content in the upper layers.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Only one stand of this shrubland type was observed and sampled near the northeastern monument boundary. The stand was linear (less than 15 m wide), growing on both banks of a narrow and incised drainage for approximately 20 m. *Salix ligulifolia* was the dominant shrub (approximately 60% foliar cover) at a height of 4–5 m. An additional 5–10% foliar cover within the stand was provided by the shrubs *Salix exigua*, *Dasiphora fruticosa*, *Ribes inermis*, and *Rosa woodsii*. Herbaceous cover for this shrubland type was approximately 20%, but no forbs or graminoids individually provided greater than 2–3% herbaceous cover. Graminoids common to this type included the natives *Carex nebrascensis* and *Juncus balticus* and the exotics *Bromus inermis*, *Poa pratensis*, and *Agrostis stolonifera*. Common forbs included *Heracleum maximum*, *Maianthemum stellatum*, *Equisetum arvense*, *Mertensia ciliata*, and the exotic *Cirsium arvense*. Because a steep cutbank was adjacent to the plot established, some cover was recorded for upland species present. Ground cover at this site was predominantly litter, approximately 90%, with most of the remainder comprised of flowing water.

This small stand is below the minimum mapping unit for the project, but because of its known location could be mapped as a park special. Its aerial photograph signature is identical to other willow associations in the monument, e.g., dark green to nearly black on true color and bright pink to dull red on CIR.

**Global Vegetation:** This association has a canopy dominated by 15-66% cover of *Salix ligulifolia* usually mixed with several other willow species. *Salix ligulifolia* is the key diagnostic species, other willows may have equal cover, but in general do not exceed that of *Salix ligulifolia*. Other willows that may be present include: *Salix monticola* (3-43% cover), *Salix geyeriana* (1-12% cover), *Salix bebbiana* (3% cover), *Salix lucida* ssp. *lasiandra* (1-20% cover), *Salix exigua* (1-10% cover), *Salix wolfii* (11% cover), and *Salix planifolia* (8% cover). Additional shrubs that may be present include *Alnus incana* (3-10% cover), *Cornus sericea* (21%), and *Dasiphora fruticosa* ssp. *floribunda* (1-9% cover). The herbaceous undergrowth can be dense in undisturbed stands with *Carex utriculata* (1-40%), *Carex nebrascensis* (1-5%), *Carex lanuginosa* (1-3%), *Juncus balticus* (1-20%), and *Calamagrostis canadensis* (1-27%). Forb cover is generally low, but some species are abundant: *Taraxacum officinale* (1-10%), *Achillea millefolium* (1%), *Thalictrum fendleri* (1-19%), and *Fragaria virginiana* (1-12%).

**Global Dynamics:** *Salix ligulifolia* is highly palatable to livestock, therefore, season long grazing, especially late summer and early fall browsing, should be avoided in order to maintain the vigor of woody species (Hansen *et al.* 1995). Overuse by livestock may cause the site to dry and become dominated by introduced grass species such as *Poa pratensis* or *Bromus inermis* (Manning and Padgett 1995). With continued overuse, the willow species will decline and eventually become eliminated from the site (Hansen *et al.* 1995). Beaver can be important in maintaining this plant association. Beaver dams raise the water table, which is beneficial to willow and sedge species as well as other hydrophytic plants. Beaver dams also help control bank erosion, channel downcutting, and the loss of sediment downstream (Hansen *et al.* 1995).

Prescribed fires may be useful for rejuvenating *Salix ligulifolia* since this willow vigorously sprouts after burning, especially in wetter areas (Hansen *et al.* 1995). Willow roots provide stream bank stability and should be considered by managers for stream bank restabilization projects and revegetation purposes (Hansen *et al.* 1995, Padgett *et al.* 1989).

This association appears to be long-lived mid to late-seral type since the stands are associated with beaver activity and saturated soils throughout the growing season.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix ligulifolia</i>
Graminoid	<i>Carex nebrascensis</i> , <i>Juncus balticus</i> , <i>Poa pratensis</i>
Forb	<i>Heracleum maximum</i> , <i>Mertensia ciliata</i> , <i>Equisetum arvense</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix ligulifolia</i>
Graminoid	<i>Carex nebrascensis</i> , <i>Juncus balticus</i> , <i>Poa pratensis</i>
Forb	<i>Heracleum maximum</i> , <i>Mertensia ciliata</i> , <i>Equisetum arvense</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix ligulifolia</i> , <i>Salix exigua</i>
Graminoid	<i>Carex nebrascensis</i> , <i>Juncus balticus</i>
Forb	<i>Equisetum arvense</i> , <i>Heracleum maximum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

##### Global

<u>Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

- *Salix exigua* - *Salix ligulifolia* Shrubland (CEGL002655)—found at lower elevations in the Colorado Front Range foothills.

#### SYNONYMY:

- DRISCOLL FORMATION CODE:III.B.3.c. (Driscoll *et al.* 1984) B
- *Salix ligulifolia* (Bourgeron and Engelking 1994) =
- *Salix eriocephala* var. *ligulifolia*/mesic graminoid plant association (Kittel *et al.* 1996) =
- *Salix ligulifolia*-*Salix monticola* plant association (Richard *et al.* 1996) =
- *Salix ligulifolia*-*Cornus sericea* plant association (Bourgeron and Engelking 1994) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G2G3.

**Global Classification Comments:** The stand at Florissant Fossil Beds National Monument is boarder-line between the foothills *Salix exigua* – *Salix ligulifolia* Shrubland (CEGL002655) and the montane *Salix ligulifolia* Shrubland (CEGL001218) in Colorado. The

overwhelming abundance of *Salix ligulifolia* (60%) to relatively low cover of *Salix exigua* (<10%), and the elevation (8400 feet) place it in the upper elevation, *Salix ligulifolia* Shrubland.

Dorn (1995) has combined *Salix lutea* and *Salix ligulifolia* (as used in Colorado literature) into *Salix eriocephala*. Nearly all Colorado specimens called *Salix lutea* and *Salix ligulifolia* have been placed into *Salix eriocephala* var. *ligulifolia*. *Salix lutea* specimens found in the extreme northwestern part of Colorado (north of Dinosaur National Monument) have been renamed *Salix eriocephala* var. *watsonii*, and *Salix lutea* specimens from extreme northeastern Colorado (along the South Platte River near Julesburg) have been renamed *Salix eriocephala* var. *famelica*. Kartesz (1999) accepts *Salix lutea* and *Salix ligulifolia* as valid species. Colorado specimens of *Salix lutea*, *Salix ligulifolia*, and *Salix eriocephala* var. *ligulifolia* are called *Salix ligulifolia* by the Kartesz (1999) treatment.

Several closely related *Salix lutea*-dominated community types occur in Montana (Hansen et al. 1995), eastern Wyoming and western Idaho (Youngblood et al. 1985a), and in Nevada (Manning and Padgett 1995). These communities would be dominated by *Salix eriocephala* var. *watsonii*, if we apply Dorn's (1995) nomenclature.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Only one stand of *Salix ligulifolia* Shrubland growing along an unnamed drainage in the northeastern portion of the monument was observed and sampled. This stand was approximately 50 m west of a hiking trail that crosses the drainage on a wooden foot bridge.

**Global Range:** This association occurs in the mountains of Colorado, where it has a fairly broad range. This association is known from the San Juan National Forest, Rio Grande National Forest, Pike-San Isabel National Forest, and the Arapaho-Roosevelt National Forest.

**Nations:** US

**States/Provinces:** CO NM?

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 73

**Classification Confidence:** 2 **Identifier:** Cegl001218

**REFERENCES:** Baker 1989b, Bourgeron and Engelking 1994, Dorn 1995, Dorn 1997, Driscoll et al. 1984, Hansen et al. 1995, Kartesz 1999, Kittel and Lederer 1993, Kittel et al. 1996, Kittel et al. 1999, Manning and Padgett 1995, Padgett et al. 1989, Richard et al. 1996, Rosgen 1996, Youngblood et al. 1985a

### III.B.2.N.d.40. SALIX MONTICOLA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Mountain Willow Temporarily Flooded Shrubland Alliance

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#### SALIX MONTICOLA / CAREX UTRICULATA SHRUBLAND

Mountain Willow / Beaked Sedge Shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This plant association is found throughout the southern Rocky Mountains ecoregion in Colorado. It occurs on and along wet banks and terraces of low-gradient, subalpine streams (2500-3100 m, 8300-10,240 feet) in broad valley bottoms, commonly near beaver ponds. Soils are heavy (clay loam, sandy clay loam, heavy silty clay textures), often with significant organic matter. This plant association is a tall (1.5-2.5 m, 5-8 feet), deciduous shrubland with an open canopy of willows and a thick understory of grasses and sedges. Willows establish on higher hummocks while *Carex utriculata* establishes at the water margins and in wet swales between willow hummocks. The willow canopy is dominated by *Salix monticola* (10-80% cover), although other species (with percent cover) may include *Salix geyeriana* (4-40%), *Salix brachycarpa* (2-28%), *Salix drummondiana* (1-20%), *Salix ligulifolia* (= *Salix eriocephala* var. *ligulifolia*) (1-11%), and *Salix boothii* (1%). The undergrowth is dominated by patches of *Carex utriculata* (1-44% cover), but *Carex aquatilis* (1-11% cover), *Deschampsia caespitosa*, and *Calamagrostis canadensis* are often present as well. Total forb cover is generally <10% cover, and may include *Cardamine cordifolia*, *Mertensia ciliata*, and *Heracleum maximum*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This shrubland is one of the most common willow types within the monument, occupying narrow, low-gradient streams of 2–3% slopes. The stands are linear, growing in saturated gravel and peat substrates immediately adjacent to the flowing water, thus serving to anchor streambanks resulting in drainage incision up to 1.5 m. Along the middle reach of Grape Creek there are many beaver dams and ponds within this vegetation type. Mountain willow shrubs grow along the edge of the floodplain, on the margins of the beaver ponds, and persist as shorter and younger shrubs than in other areas. These shrubs undoubtedly began as root sprouts following foraging and dam-building activities by the beaver.

**Global Environment:** This association occurs along wet banks and terraces of low-gradient, subalpine streams (2500–3100 m, 8300–10,240 feet) in broad valley bottoms, commonly near beaver ponds. Soils are heavy (clay loam, sandy clay loam, heavy silty clay textures), often with significant organic matter. Willows establish on higher hummocks while *Carex utriculata* establishes at the water margins and in wet swales between willow hummocks. It can form very wide and thick shrublands in broad valley bottoms, or it can occur as a narrow strip of linear vegetation along smaller streams in narrow, constricted tributaries.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Stands of this shrubland are linear, the willow shrubs growing immediately adjacent to the flowing water of each stream. *Salix monticola* was the dominant shrub, attaining heights of 2–5 m and providing foliar cover from 40–65% in individual plots and stands. Associated shrubs included *Dasiphora fruticosa* ssp. *floribunda* and *Ribes aureum* which never provided foliar cover greater than 1% for the stands sampled. Graminoid species provided foliar cover of 40–75%. *Carex utriculata* was the dominant native graminoid (approximately 15–50% foliar cover). Other graminoids common to these stands included *Carex aquatilis* and *Deschampsia caespitosa*. Forbs contributed from 5–25% foliar cover, the most abundant was *Heracleum maximum* (approximately 20% cover on one plot). Common forbs present in the type included *Mertensia ciliata*, *Mentha arvensis*, *Achillea millefolium*, and *Equisetum arvense*. Ground cover within sampled stands was predominantly litter (approximately 60–95%); one stand had an abundance of woody litter, approximately 30%.

Linear stands of this shrubland often are below the project minimum mapping unit. Along some stream reaches, however, these stands are mappable from a dark green to nearly black signature on true color aerial photos and bright pink on CIR photography.

**Global Vegetation:** This plant association is a tall (1.5–2.5 m, 5–8 feet), deciduous shrubland with an open canopy of willows and a thick understory of grasses and sedges. The willow canopy is dominated by *Salix monticola* (10–80% cover), although other species (with percent cover) may include *Salix geyeriana* (4–40%), *Salix brachycarpa* (2–28%), *Salix drummondiana* (1–20%), *Salix ligulifolia* (= *Salix eriocephala* var. *ligulifolia*) (1–11%), and *Salix boothii* (1%). *Ribes* spp. are often present in low abundance. The undergrowth is dominated by patches of *Carex utriculata* (1–44% cover), but *Carex aquatilis* (1–11% cover), *Deschampsia caespitosa*, and *Calamagrostis canadensis* are often present as well. Total forb cover is generally <10% cover and may include *Cardamine cordifolia*, *Mertensia ciliata*, and *Heracleum maximum*.

**Global Dynamics:** *Salix monticola* appears to be less tolerant of browsing pressure than other tall montane willow species. It responds to heavy browsing pressure in the same way that *Salix geyeriana* does; it forms the classic “mushroom” shape with over browsing by deer and cattle (Hansen et al. 1995). *Carex* species can be heavily grazed by livestock in narrow riparian areas in mid-elevation rangelands. Improper grazing by livestock in this plant association can dry sites, increase non-native cover, and reduce the vigor of willow root structure. The wet and often saturated soils of this plant association are also vulnerable to compaction by livestock and heavy equipment. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen et al. 1995).

Changes in the physical environment, brought on by flooding or other disturbance, can initiate successional shifts in species composition. Sediment deposition on the floodplain raises the surface higher above the water table. As aggradation, or build up, of the floodplain proceeds, the site becomes drier and the dominant graminoid understory changes. Thus *Carex aquatilis*-dominated stands (regardless of any overstory canopy) may shift toward *Calamagrostis canadensis*-dominated stands.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix monticola</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Carex utriculata</i> , <i>Carex aquatilis</i>
Forb	<i>Heracleum maximum</i> , <i>Equisetum arvense</i> , <i>Mertensia ciliata</i>

**Global**

**Stratum**

Shrub

Graminoid

Forb

**Species**

*Salix monticola*

*Carex utriculata*

*Heracleum maximum*, *Equisetum arvense*, *Mertensia ciliata*

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Shrub

Graminoid

Forb

**Species**

*Salix monticola*, *Dasiphora fruticosa*

*Carex utriculata*, *Carex aquatilis*

*Equisetum arvense*, *Heracleum maximum*, *Mertensia ciliata*

**Global**

**Stratum**

Shrub

Graminoid

Forb

**Species**

*Salix monticola*

*Carex utriculata*

*Heracleum maximum*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

- *Salix monticola* / *Carex aquatilis* Shrubland (CEGL002656)
- *Salix monticola* / *Calamagrostis canadensis* Shrubland (CEGL001222)

**SYNONYMY:**

- *Salix drummondiana*-*Salix monticola*/*Calamagrostis canadensis*-*Carex utriculata* (Baker 1989b) B

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G3.

**Global Classification Comments:** Classification is based on 13 quantitative plots in Colorado, the only known area of occurrence. In the understory *Carex utriculata* is either the clear dominant or is most consistently present throughout the stand. This distinguishes this association from *Salix monticola* / *Carex aquatilis* Shrubland (CEGL002656) and *Salix monticola* / *Calamagrostis canadensis* Shrubland (CEGL001222).

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Salix monticola* / *Carex utriculata* Shrubland is present at scattered localities along Grape Creek and its tributary drainages within the monument. The elevations are relatively low in the monument, from approximately 8250-8450 feet

**Global Range:** This plant association is found throughout the southern Rocky Mountains ecoregion in Colorado.

**Nations:** US

**States/Provinces:** CO

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 35, 45

**Classification Confidence:** 1 **Identifier:** CEGL002657

**REFERENCES:** Baker 1989b, Cooper and Cottrell 1990, Hansen et al 1995, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999, Richard et al. 1996

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**SALIX MONTICOLA / MESIC GRAMINOIDS SHRUBLAND**

Mountain Willow / Mesic Graminoids Shrubland

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This association is known only from Colorado but may occur in the mountains of New Mexico and Utah. It dominates broad, swift mountain streams (2400-3100 m, 7800-10,200 feet) with active floodplains. Stands usually occur 0.5 m (2 feet) above the bankfull channel up to 15 m (50 feet) away from the stream edge in both narrow and wide valleys (20-120 m, 65-400 feet wide). The soils are fine-textured loams, and the ground surface is usually undulating due to past flooding or beaver activity. *Salix monticola* is either the dominant or most abundant species in a variable canopy (15-80% total cover). Other shrubs present at higher elevations include *Salix planifolia* (10-40% cover), *Salix geyeriana* (2-20% cover), and *Salix brachycarpa*. Species present at lower elevations include *Salix irrorata* (45% cover), *Salix lucida ssp. caudata* (= *Salix lasiandra ssp. caudata*) (1-25% cover), *Alnus incana* (4-19% cover), *Ribes aureum* and *Dasiphora fruticosa ssp. floribunda* (= *Pentaphylloides floribunda*). The herbaceous undergrowth is diverse, with a variety of graminoid (grass and grass-like) and forb species. This association is distinguished from *Salix monticola* / Mesic Forbs Shrubland (CEGL002658) by having a higher cover of graminoid species. Stands with predominantly non-native graminoid species in the undergrowth are considered grazing-induced.

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This shrubland is present as patches within the monument, occupying narrow, low-gradient streams of 2–3% slopes. The stands are linear, growing in saturated gravel and peat substrates immediately adjacent to the flowing water, thus also serving to anchor streambanks resulting in drainage incision up to 1.5 m.

**Global Environment:** Stands usually occur 0.5 m (2 feet) above the bankfull channel up to 15 m (50 feet) away from the stream edge in both narrow and wide valleys (20-120 m, 65-400 feet wide). The soils are fine-textured loams, and the ground surface is usually undulating due to past flooding or beaver activity.

**VEGETATION DESCRIPTION**

**Florissant Fossil Beds NM Vegetation:** Stands of this shrubland are linear, the willow shrubs growing immediately adjacent to the flowing water of the stream. *Salix monticola* was the dominant shrub, attaining heights of 2-5 m and providing foliar cover from 40-45%. Associated shrubs included *Ribes aureum*, but never provided foliar cover greater than 1% for the stands sampled. Graminoid species provided foliar cover in excess of 50%. At one site, the exotic *Phalaris arundinacea* (approximately 45% foliar cover) was the dominant mesic graminoid. Other graminoids common to these stands included *Carex utriculata*, *Bromus inermis*, and *Poa pratensis*. Forbs contributed approximately 25% foliar cover, the most abundant was *Heracleum maximum* (approximately 20% cover). Common forbs present in the type included *Mertensia ciliata*, *Mentha arvensis*, *Achillea millefolium*, and *Equisetum arvense*. Ground cover within sampled stands was predominantly litter (approximately 60%); one stand had an abundance of woody litter, approximately 30%.

Linear stands of this shrubland often are below the project minimum mapping unit. Along some stream reaches, however, these stands are mappable from a dark green to nearly black signature on true color aerial photos and bright pink on CIR photography.

**Global Vegetation:** *Salix monticola* is either the dominant or most abundant species in a variable canopy (15-80% total cover). Other shrubs present at higher elevations include *Salix planifolia* (10-40% cover), *Salix geyeriana* (2-20% cover), and *Salix brachycarpa*. Species present at lower elevations include *Salix irrorata* (45% cover), *Salix lucida ssp. caudata* (= *Salix lasiandra ssp. caudata*) (1-25% cover), *Alnus incana* (4-19% cover), *Ribes aureum*, and *Dasiphora fruticosa ssp. floribunda* (= *Pentaphylloides floribunda*). The herbaceous undergrowth is diverse, with a variety of graminoid (grass and grass-like) and forb species. This association is distinguished from *Salix monticola* / Mesic Forbs Shrubland (CEGL002658) by having a higher cover of graminoid species, including *Calamagrostis canadensis*, *Carex utriculata*, *Carex aquatilis*, and *Poa pratensis*. Stands with predominantly non-native graminoid species in the undergrowth are considered grazing-induced.

**Global Dynamics:** This shrubland association appears to be a stable, long-lived community. Stands with an abundance of *Poa pratensis* or *Agrostis stolonifera* may be a grazing-induced disclimax. Stands with abundant *Salix planifolia* may indicate a transition between higher elevational sites dominated by *Salix planifolia* and lower elevational sites where *Salix monticola* is more abundant.

**MOST ABUNDANT SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Shrub

**Species**

*Salix monticola*, *Ribes aureum*



Graminoid                      *Phalaris arundinacea, Carex utriculata, Bromus inermis*  
Forb                              *Heracleum maximum, Equisetum arvense, Mertensia ciliata*

**Global**

**Stratum**

**Species**

Shrub                              *Salix monticola, Ribes aureum*  
Graminoid                      *Calamagrostis canadensis, Carex utriculata, Carex aquatilis*  
Forb                                *Mertensia ciliata, Achillea millefolium, Taraxacum officinale*

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

**Species**

Shrub                              *Salix monticola*  
Graminoid                      *Phalaris arundinacea, Carex utriculata*  
Forb                                *Heracleum maximum, Equisetum arvense, Mertensia ciliata*

**Global**

**Stratum**

**Species**

Shrub                              *Salix monticola*  
Graminoid                      *Calamagrostis canadensis, Carex utriculata, Carex aquatilis*  
Forb                                *Mertensia ciliata, Achillea millefolium, Taraxacum officinale*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

- *Salix monticola* / Mesic Forbs Shrubland (CEGL002658)

**SYNONYMY:**

- *Salix monticola-Salix planifolia*/Mesic forb (Kittel et al. 1995) I

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G3.

**Global Classification Comments:** Classification is based on 14 quantitative plots in the Gunnison and South Platte river basins as well as the San Juan National Forest in Colorado.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Salix monticola* / Mesic Graminoids Shrubland is present at scattered localities along Grape Creek and its tributary drainages within the monument. The elevations are relatively low in the monument, from approximately 8250-8450 feet

**Global Range:** This association is known only from Colorado but may occur in the mountains of New Mexico and Utah.

**Nations:** US

**States/Provinces:** CO

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** No quantitative plot taken. Description is from qualitative observations of stands in the park.

**Classification Confidence:** 1    **Identifier:** CEGL002659

**REFERENCES:** Kittel et al. 1995, Kittel et al. 1997, Kittel et al. 1999, Richard et al. 1996

### III.B.2.N.e. Seasonally flooded cold-deciduous shrubland

#### III.B.2.N.e.13. SALIX BRACHYCARPA SEASONALLY FLOODED SHRUBLAND ALLIANCE

##### Short-fruit Willow Seasonally Flooded Shrubland Alliance

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##### SALIX BRACHYCARPA / CAREX AQUATILIS SHRUBLAND

##### Short-fruit Willow / Aquatic Sedge Shrubland

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###### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association is known from the upper montane zones of the Rocky Mountains. Specifically it is known from the upper South Platte River Basin, the Rio Grande National Forest, and the San Juan National Forest in southwestern Colorado. It is likely to occur in Utah. *Salix brachycarpa* is an abundant low-stature (1-3 feet, 0.3-1 m) willow of first and second-order streams of subalpine elevations (9200-10,200 feet) in Colorado. It is unusual for *Salix brachycarpa* to occur with *Carex aquatilis* since *Salix brachycarpa* typically grows on drier sites. This association occurs on low floodplains immediately adjacent to the stream channel. Stream reaches are broad, low gradient, and meandering or braided. The water table can be within the first 8 inches (20 cm) of soil early in the season. Since *Salix brachycarpa* is typically not associated with *Carex aquatilis*, this plant association may indicate that a site was once wetter and is now becoming drier allowing *Salix brachycarpa* to establish. *Salix brachycarpa* is the dominant shrub with 15-20% cover. Other shrubs present include *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix wolfii*, and *Salix monticola*. The understory is a thick carpet of grasses and grass-like plants dominated by 15-30% cover of *Carex aquatilis*. Forb cover is sparse. In Colorado, occurrences of this plant association also have *Dasiphora fruticosa* ssp. *floribunda* and *Juncus balticus* var. *montanus* which increase in abundance under persistent heavy livestock grazing. These sites may be shifting from wetter plant associations to drier *Dasiphora fruticosa* ssp. *floribunda* or *Salix brachycarpa* associations.

###### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This shrubland association is unusual within the monument; only one stand was observed on a small tributary drainage to Grape Creek. This drainage was flowing down a 3% gradient, and the associated floodplain was saturated to the surface. The stand occupied both edges of the flowing stream at the base of outwash or toeslope sediments from an adjacent ridge.

**Global Environment:** This association occurs on low floodplains immediately adjacent to the stream channel. Stream reaches are broad, low-gradient, and meandering or braided. The water table can be within the first 20 cm (8 inches) of soil early in the season. Since *Salix brachycarpa* is typically not associated with *Carex aquatilis*, this plant association may indicate that a site was once wetter and is now becoming drier allowing *Salix brachycarpa* to establish.

###### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Only one stand of this shrubland was observed and sampled, near the northern monument boundary. The stand is linear, not more than 15 m wide and less than 100 m long. *Salix brachycarpa* was the dominant shrub at a height of 1–2 m and provided approximately 20% foliar cover. An additional 5–7% foliar cover was provided by the tall (2–5 m) shrub *Salix monticola* and short-stature *Dasiphora fruticosa*, *Ribes inerme*, and *Rosa woodsii*. *Carex aquatilis* was the dominant graminoid, providing approximately 40% foliar cover, with *Carex utriculata*, *Juncus balticus*, *Deschampsia caespitosa*, *Calamagrostis canadensis*, and the exotic grasses *Bromus inermis* and *Poa pratensis* contributing approximately 10% foliar cover. Forbs common to this stand included *Mertensia ciliata*, *Potentilla plattensis*, *Achillea millefolium*, *Mentha arvensis*, and *Cirsium scariosum* (= *Cirsium tioganum*), in addition to several other species; they contributed approximately 5% foliar cover. Ground cover within the stand was approximately 90% litter, in addition to standing/flowing water and woody litter.

This small stand is below the minimum mapping unit for the project, but because of its known location could be mapped as a park special. It is part of the patchy distribution of willow shrubs within the monument. Its aerial photograph signature is identical to other willow associations in the monument, e.g., dark green to nearly black on true color and bright pink on CIR.

**Global Vegetation:** *Salix brachycarpa* is the dominant shrub with 15-70% cover. Other shrubs present include *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix wolfii*, and *Salix monticola*. The understory is a thick carpet of grasses and grass-like plants dominated by 15-30% cover of *Carex aquatilis*. Other graminoids that may be present include *Carex utriculata* (2-15%), *Juncus balticus* var. *montanus* (1-22%), *Carex scopulorum* (21%), *Carex interior* (2-10%), and *Deschampsia caespitosa* (3-10%).

Forb cover is generally sparse to occasionally lush and usually diverse. Forb species include *Thermopsis divaricarpa*, *Maianthemum stellatum*, and *Potentilla* spp.

**Global Dynamics:** *Salix planifolia*, *Salix brachycarpa*, and *Salix wolfii* are abundant low-statured (1-3 feet, 0.3-1 m) willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix brachycarpa* grows on lateral moraines, coarse-textured streambanks, ridgetops and on small hummocks (Kittel 1994).

It is unusual for *Salix brachycarpa* to occur with *Carex aquatilis* since *Salix brachycarpa* typically grows on drier sites. Soil data indicate that occurrences of this plant association are perennially wet or have been in the past. It is possible that with heavy grazing and recreational use, these sites have begun to dry out and *Salix brachycarpa* is becoming established. In the South Platte River Basin, occurrences of this plant association also have abundant *Pentaphylloides floribunda* and *Juncus balticus* var. *montanus* which are increaser species under persistent heavy livestock grazing. These sites may be shifting from wetter *Salix monticola* or *Salix planifolia* associations to drier *Pentaphylloides floribunda* or *Salix brachycarpa* associations (Kittel et al. 1997).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix brachycarpa</i> , <i>Salix monticola</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Carex aquatilis</i> , <i>Carex utriculata</i> , <i>Juncus balticus</i>
Forb	<i>Mertensia ciliata</i> , <i>Potentilla plattensis</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix brachycarpa</i> , <i>Dasiphora fruticosa</i>
Graminoid	<i>Carex aquatilis</i> , <i>Carex utriculata</i> , <i>Juncus balticus</i>
Forb	<i>Cardamine cordifolia</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix brachycarpa</i>
Graminoid	<i>Carex aquatilis</i> , <i>Carex utriculata</i>
Forb	<i>Mertensia ciliata</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Salix brachycarpa</i>
Graminoid	<i>Carex aquatilis</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

##### SYNONYMY:

- DRISCOLL FORMATION CODE:III.B.3.d. (Driscoll et al. 1984) B
- *Salix brachycarpa*/*Carex rostrata* (Bourgeron and Engelking 1994) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G2G3.

**Global Classification Comments:** The *Salix brachycarpa* / *Carex aquatilis* and the *Salix brachycarpa* / *Calamagrostis canadensis* plant associations were previously described by Bierly (1972) from Rocky Mountain National Park, Colorado. However, researchers

studying wetlands in the same site as Beirly have since determined that *Salix brachycarpa* was misidentified, and that in fact *Salix wolfii* is the dominant willow at that site (Cooper 1990).

This community type is not described elsewhere in the literature (Padgett et al. (1989) mention it as a miscellaneous community type), and is known only from four plots. It consists of an odd combination of mesic and less mesic habitat demanding plant species, suggesting it may be limited to ecotonal habitats, an unusual set of environmental parameters, or sites in a relatively short-lived successional transition between wetter and drier habitats.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** One small, linear stand (<100 m long) of *Salix brachycarpa* / *Carex aquatilis* Shrubland was observed and sampled on a tributary drainage to Grape Creek, near the northern monument boundary.

**Global Range:** This association is known from the upper montane zones of the Rocky Mountains. Specifically it is known from the upper South Platte River Basin, the Rio Grande National Forest, and the San Juan National Forest in southwestern Colorado. It is likely to occur in Utah.

**Nations:** US

**States/Provinces:** CO UT?

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 67

**Classification Confidence:** 2 **Identifier:** CEG001244

**REFERENCES:** Bierly 1972, Bourgeron and Engelking 1994, CONHP n.d., Cooper 1990, Driscoll et al. 1984, Kittel 1994, Kittel et al. 1997, Kittel et al. 1999, Padgett et al. 1989

## V. HERBACEOUS VEGETATION

### V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

#### V.A.5.N.c.20. SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE

Little Bluestem - Sideoats Grama Herbaceous Alliance

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#### SCHIZACHYRIUM SCOPARIUM HERBACEOUS VEGETATION

Little Bluestem Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Soils associated with stands and patches of *Schizachyrium scoparium* Herbaceous Vegetation are thin and consist mostly of coarse gravel deposits lying over Pikes Peak Granite bedrock on toe- and midslopes of large hills. Slopes supporting this community are steep, rapidly drained, and ranged from 23–35%. Aspects were southerly and ranged from 165° to 217° for the stands sampled.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Schizachyrium scoparium* is the dominant species and is usually less than 0.5 m in height within the hillslope stands and patches. Late-season observations of little bluestem in the upper Boulder Creek drainage indicated that some plants in more sheltered areas were between 0.5 and 1.0 m tall. In general, foliar cover ranged from 40–55% for sampled stands, and the majority of the cover value was from *Schizachyrium scoparium*. *Yucca glauca* did not exceed 5% foliar cover on these sites, and *Muhlenbergia montana* was a minor secondary species. Occasional *Pinus ponderosa* trees are scattered within these stands.

Fire probably played a major role in this type, whereby periodic fires would increase graminoid production and deter tree growth. This type occurs on variable aspects throughout its range, but appears restricted to south- and west-facing slopes at the elevation and latitude limits of its distribution in the monument. Von Loh et al. (2000; 1999), Cogan, et al. (1999), McAdams, et al. (1998), and Hansen et al. (1984) report this type on southerly aspects for western South Dakota and southwestern North Dakota.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Yucca glauca</i>
Graminoid	<i>Schizachyrium scoparium</i> , <i>Muhlenbergia montana</i>

<u>Global Stratum</u>	<u>Species</u>
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#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Yucca glauca</i>
Graminoid	<i>Schizachyrium scoparium</i>

<u>Global Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** Not applicable.

**Global Classification Comments:** Not applicable.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** This community is found on hills within the monument in small stands and as patches (<0.5 ha) on steep toe- and midslopes that are south- and west-facing. The soils are coarse-textured Pikes Peak granite that exhibit settling around the little bluestem bunches.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 4, 42, 66

**Classification Confidence:** Identifier:

#### REFERENCES:

### V.A.5.N.d. Medium-tall bunch temperate or subpolar grassland

#### V.A.5.N.d.402. AGROPYRON CRISTATUM SEMI-NATURAL HERBACEOUS ALLIANCE

Crested Wheatgrass Semi-natural Herbaceous Alliance

## AGROPYRON CRISTATUM - (PASCOPYRUM SMITHII, HESPEROSTIPA COMATA) SEMI-NATURAL HERBACEOUS VEGETATION

Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread) Semi-natural Herbaceous Vegetation

### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This crested wheatgrass type occurs most commonly in the northern Great Plains of the United States and Canada. Stands occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. It is also widely planted to revegetate pastures and rangelands. The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Agropyron cristatum*, a naturalized species from Europe. Other weedy species may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata* (= *Stipa comata*), as well as others. Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Two small, nearly pure stands of this herbaceous vegetation were observed in the monument. The larger stand is dominated by *Agropyron cristatum* and occurs as a nearly pure stand on the edge of a swale in the northeastern corner of the monument. This stand occupies the margins of an active prairie dog colony and is heavily grazed. A smaller stand was observed near the western monument boundary, south of the water pipeline. Elsewhere, *Agropyron cristatum* was included in a seed mix with, and is subdominant to, *Bromus inermis* and was used to revegetate ground disturbed by historic water pipeline construction and seed potato agricultural fields. The species may also have been planted to attempt to enhance forage production for livestock and to provide erosion control.

**Global Environment:** This type can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. It is also widely planted to revegetate pastures and rangelands.

### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This exotic grassland is characterized by an almost pure stand of *Agropyron cristatum*, a medium-tall bunchgrass providing approximately 55% vegetative cover and standing less than 0.5 m in height. The litter layer is dense, although the clumps were widely enough spaced to expose nearly 30% bare soil and gravel surfaces. Only a few small stands and patches occurred as near mono-cultures within the monument, and these were located on dry ridges and slopes of Pikes Peak granite gravel and silty clay soil that had been disturbed historically by ranching and farming activities. Native species found within these stands are all disturbance-oriented and include *Artemisia frigida*, *Grindelia subalpina*, and *Oenothera coronopifolia*.

**Global Vegetation:** The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Agropyron cristatum*, a naturalized species from Europe. Other weedy species may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata* (= *Stipa comata*), as well as others.

### Global Dynamics:

### MOST ABUNDANT SPECIES

#### Florissant Fossil Beds NM

##### Stratum

Dwarf-shrub  
Graminoid  
Forb

##### Species

*Artemisia frigida*  
*Agropyron cristatum*, *Pascopyrum smithii*, *Nassella viridula*, *Bouteloua gracilis*  
*Grindelia subalpina*, *Oenothera coronopifolia*, *Linaria vulgaris*

#### Global

##### Stratum

Graminoid

##### Species

*Agropyron cristatum*

### CHARACTERISTIC SPECIES

#### Florissant Fossil Beds NM

##### Stratum

Graminoid  
Forb

##### Species

*Agropyron cristatum*, *Pascopyrum smithii*, *Nassella viridula*  
*Artemisia frigida*

**Global**

**Stratum**

Graminoid

**Species**

*Agropyron cristatum*, *Pascopyrum smithii*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** GW.

**Global Classification Comments:** Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** This semi-natural herbaceous vegetation is represented well at two sites. The first is located along the trail that leads to the northeastern corner of the monument, where the purest stand of *Agropyron cristatum* occurs approximately 200 m from the northern boundary fenceline. The second is represented south of the water pipeline corridor, near the western monument boundary.

**Global Range:** This type occurs most commonly in the northern Great Plains of the United States and Canada.

**Nations:** CA US

**States/Provinces:** MB MT ND SD SK WY

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** *Pascopyrum smithii* is reported to be planted at FLFO.

**Classification Confidence:** 3 **Identifier:** CEGLO05266

**REFERENCES:** Hansen et al. 1984

**V.A.5.N.d.400. BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE**

Smooth Brome Semi-natural Herbaceous Alliance

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**BROMUS INERMIS - (PASCOPYRUM SMITHII) SEMI-NATURAL HERBACEOUS VEGETATION**

Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY: NOTE:** This is the closest association in the NVC to that which occurs at Florissant Fossil Beds National Monument. It may not be the same association, but the authors include it as an informational reference.

This smooth brome grassland type occurs widely throughout the northern Great Plains and on relatively mesic sites in the semi-arid interior western United States, and perhaps more widely in the midwestern U.S. and Canada. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. The type is also widely planted for revegetating disturbed land, pasture, and hay fields, and has escaped into a variety of habitats including prairie, riparian grasslands, and mesic mountain meadows. In Montana, this community types occurs on elevation ranges from 1100-2050 m (3590-6700 feet) with best examples on mesic alluvial terraces. This grass grows best on moist, well-drained, finer-textured loam and clay loams and does not tolerate prolonged flooding. The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Bromus inermis*, a naturalized species from Eurasia, that forms moderately dense to dense stands that often develop into mono-cultures. Other weedy species such as *Cirsium arvense* may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie and montane meadow grasses, such as *Pascopyrum smithii*, *Deschampsia caespitosa*, and *Hesperostipa comata* (= *Stipa comata*) and sparse, scattered mesic shrubs such as *Symphoricarpos* spp. as well as many others. However, the native species are not conspicuous enough to identify the native plant association that could occupy the site or the stand would be typed as such.

## ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This semi-natural herbaceous vegetation forms nearly pure stands along Teller County 1, southern Grape Creek, slopes across from the parking lot entrance on Lower Twin Rocks Road, along the southern fenceline near a series of livestock ponds, and along the westernmost portion of the water pipeline corridor. It was certainly introduced in a seed mix used to revegetate ground disturbed by historic water pipeline construction, road construction, and seed potato field restoration. The species was likely planted to attempt to enhance forage production for livestock in addition to erosion control. These stands are relatively dense on upper floodplain terraces, but are sparse on the old agricultural fields and portions of the water pipeline.

**Global Environment:**

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This exotic grassland is characterized by nearly pure stands of *Bromus inermis*, a medium-tall rhizomatous grass. Dense stands occurred on mesic sites along the monument roads and in sites used as grass hay fields until recently; these are found near the eastern monument boundary at Lower Twin Rock Road, at the southern monument boundary near a series of stock ponds, and at the western monument boundary adjacent to the water pipeline corridor. On sites that were more recently hayed and mesic sites, *Bromus inermis* cover values ranged from approximately 55–70%. Commonly associated species included the exotic *Poa pratensis* and *Agropyron cristatum* in more mesic pastures and swales. Older stands that had been planted on historic seed potato fields and on dry hilltops, ridges, and flats are reverting to native, disturbance-oriented species. Where moisture collects along terraces within historic potato fields, *Bromus inermis* is dominant; however, on dry lands between terraces, *Bromus inermis* cover was approximately 15%, and *Muhlenbergia filiculmis* had a cover value of approximately 25%. Within dense stands of *Bromus inermis*, the ground cover value for litter exceeds 95%, however, on drier sites bare soil and gravel provide approximately 70–80% of the ground cover.

An effort to revegetate the water pipeline corridor with native grassland species is being planned and seed is being collected from the monument to provide local genetic stock.

**Global Vegetation:**

**Global Dynamics:**

## MOST ABUNDANT SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Bromus inermis</i> , <i>Agropyron cristatum</i> , <i>Poa pratensis</i> , <i>Muhlenbergia filiculmis</i> , <i>Koeleria macrantha</i>

**Global**

<u>Stratum</u>	<u>Species</u>
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## CHARACTERISTIC SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bromus inermis</i> , <i>Agropyron cristatum</i> , <i>Muhlenbergia filiculmis</i>

**Global**

<u>Stratum</u>	<u>Species</u>
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## OTHER NOTEWORTHY SPECIES

**Florissant Fossil Beds NM**

**Global**

<u>Stratum</u>	<u>Species</u>
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**GLOBAL SIMILAR ASSOCIATIONS:**



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## GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:**

**Global Classification Comments:**

### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** This semi-natural herbaceous vegetation occurs on disturbed sites and in moist drainages throughout the monument. The purest stands lie adjacent to Lower Twin Rock Road, south of the parking lot entrance, adjacent to Teller County 1, and in drainages and on slopes adjacent to the water pipeline corridor near the western edge of the monument.

**Global Range:**

**Nations:** US

**States/Provinces:** CO

### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 1, 22, 49, 57

**Classification Confidence:** **Identifier:** CEGLO05264

**REFERENCES:**

## V.A.5.N.d.2. FESTUCA ARIZONICA HERBACEOUS ALLIANCE

Arizona Fescue Herbaceous Alliance

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### FESTUCA ARIZONICA - MUHLENBERGIA FILICULMIS HERBACEOUS VEGETATION

Arizona Fescue - Slim-stem Muhly Herbaceous Vegetation

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### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This is an arid mixed-grass meadow association found on steep southwest slopes between 8000 and 10,120 feet elevation. Known only from south-central mountains of Colorado, it appears to be restricted to dry, rocky south-facing steep slopes. Dominant grasses are *Festuca arizonica*, *Muhlenbergia filiculmis*, *Bouteloua gracilis*, *Elymus elymoides*, and *Koeleria macrantha*. Total herbaceous cover is 25-50%. Forbs consist of less than 5% foliar cover. Few scattered dwarf-shrubs may be present such as *Artemisia frigida*, *Chrysothamnus viscidiflorus*, and *Ericameria parryi*, but these species rarely exceed 5% foliar cover. The main distinction between this grassland and *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001780) is the presence to nearly equal cover of *Festuca arizonica*.

### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Thin, gravelly soils support this herbaceous vegetation. This grassland type occupies upper hill and ridge slopes and low hill and ridgetops within the monument. It is occasionally observed on lower slopes with southern exposures.

**Global Environment:** This is an arid mixed-grass meadow association found on steep southwest slopes between 8000 and 10,120 feet elevation. Rocks and boulders can be abundant, but bare ground and litter are the predominate ground cover. Slope ranges from 5-31 degrees (5.5-34%), with southwest slopes most common, on upper hill and ridge slopes and lower hill and ridgetops.

### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation is present but scattered within the monument. It is common to find a few dwarf-shrubs in the type, particularly *Artemisia frigida*, *Chrysothamnus viscidiflorus*, and *Ericameria parryi*, but these species rarely exceed 5% foliar cover within a stand. The dominant and common graminoids include *Festuca arizonica*, *Muhlenbergia filiculmis*, *Bouteloua gracilis*, *Elymus elymoides*, and *Koeleria macrantha*. The foliar cover estimated for graminoids ranged from approximately 25% to as much as 45%, depending on exposure. Forbs are diverse within this association and typically provide from 1-5% foliar cover. The more common forb species include *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Oxytropis lambertii*, *Geranium caespitosum*, *Antennaria parvifolia*, and *Besseyia plantaginea*. Ground cover consisted of 50-75% litter and 20-50% gravel for most stands sampled. The ground cover provided by mosses and lichens may be significant, ranging from 20-35%. On one site, approximately 25% cover by the cryptogam *Selaginella densa* was recorded.

This herbaceous community has a fairly consistent signature, both on true color and CIR aerial photos.

**Global Vegetation:** This arid grassland has total cover ranging from 31-70% foliar cover. Dominant graminoids are *Muhlenbergia filiculmis*, *Festuca arizonica*, *Bouteloua gracilis*, and *Koeleria macrantha*. A few dwarf-shrubs can occur scattered throughout the stand, including *Artemisia frigida*, *Chrysothamnus viscidiflorus*, and *Ericameria parryi*, but these species rarely exceed 5% foliar cover. Moss and lichen cover ranges from 3-35%, depending on the aspect of the site.

**Global Dynamics:**

**MOST ABUNDANT SPECIES**

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

**Global**

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i> , <i>Elymus elymoides</i> , <i>Koeleria macrantha</i>
Forb	<i>Oxytropis lambertii</i> , <i>Besseyia plantaginea</i> , <i>Antennaria parvifolia</i> , <i>Hymenoxys richardsonii</i>

**Global**

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

<u>Global Stratum</u>	<u>Species</u>
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**GLOBAL SIMILAR ASSOCIATIONS:**

*Muhlenbergia filiculmis* (CEGL001780) very similar to this association

**SYNONYMY:**

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B
- *Festuca arizonica*-*Muhlenbergia filiculmis* (Bourgeron and Engelking 1994) =

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** GU.

**Global Classification Comments:** The differences between this association, *Festuca arizonica* – *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001605), and *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001780) are minor. The species composition is very similar (forbs varying the most). At Florissant Fossil Beds National Monument, plots of the later were taken well within stands of the former. These stands were described as round or oval in shape. This is due to the landscape position on the tops of small hills and low ridges. The growth form of *Muhlenbergia filiculmis* is also interesting. One might consider it a large clone with various grasses growing in the inner circle, part of the natural variability of the grassland as a whole, rather than as its own plant association.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Festuca arizonica* – *Muhlenbergia filiculmis* Herbaceous Vegetation is present sporadically within the monument. This type occupies the hill and ridgetops and some slopes throughout the lower and middle elevations.

**Global Range:** This grassland is known only from south-central Colorado mountains: the northern low hills of the San Luis Valley, the upper Rio Grande valley near Creede, and from Florissant Fossil Beds National Monument.

**Nations:** US

**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 23, 64, 88

**Classification Confidence:** 3    **Identifier:** CEG001605

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Shepherd 1975, Stewart 1940

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### FESTUCA ARIZONICA - MUHLENBERGIA MONTANA HERBACEOUS VEGETATION

Arizona Fescue - Mountain Muhly Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association occurs from 2135-3050 m (7000-10,000 feet) in elevation on gently to steeply sloping rocky sites at all aspects in forest openings or on mesa tops in Colorado, Texas, and possibly New Mexico and Arizona. This grassland community is dominated by *Festuca arizonica* and *Muhlenbergia montana*. Open *Pinus ponderosa* woodlands with similar understory species composition often occur adjacent to this association. Common graminoids and forbs present in lower abundance are *Bouteloua gracilis*, *Muhlenbergia filiculmis*, *Koeleria macrantha*, *Schizachyrium scoparium*, *Hymenoxys richardsonii*, *Antennaria parvifolia*, and *Arenaria fendleri*. *Festuca arizonica*, *Muhlenbergia montana*, and *Schizachyrium scoparium* are preferentially grazed and will be replaced by *Bouteloua gracilis*, *Artemisia frigida*, and *Hymenoxys richardsonii* with repeated heavy grazing. This association can be differentiated from *Muhlenbergia montana* Herbaceous Vegetation (CEGL001646) by the presence and often near equal abundance of *Festuca arizonica*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Deep soils, to 10 cm thick, support this herbaceous vegetation. This common bunchgrass grassland occupies flats, gentle to steep slopes, hills, ridges, and drainage sides within the monument. The more mesic of these exposures support *Festuca arizonica* and the drier exposures favor *Muhlenbergia montana*.

**Global Environment:** This association occurs from 2135-3050 m (7000-10,000 feet) in elevation on gently to steeply sloping rocky sites at all aspects in forest openings or on mesa tops. In Florissant Fossil Beds National Monument it occupies deep soils (10 cm) on flats, gentle to steep slopes, hills, ridges, and drainage sides. More mesic exposures support *Festuca arizonica* and the drier exposures favor *Muhlenbergia montana*.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation association is common within the monument. Typically a few dwarf-shrubs are present in the type, particularly *Artemisia frigida*, *Chrysothamnus viscidiflorus*, and *Ericameria parryi*, but these species rarely exceed 5% foliar cover. The dominant and common graminoids include *Festuca arizonica*, *Muhlenbergia montana*, *Muhlenbergia filiculmis*, *Bouteloua gracilis*, *Elymus elymoides*, and *Koeleria macrantha*. The foliar cover estimated for graminoids was over 50%. Forbs are diverse within this association and typically provide from 5–10% foliar cover. The more common forb species include *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Oxytropis lambertii*, *Geranium caespitosum*, *Antennaria parvifolia*, and *Besseyia plantaginea*. Ground cover consisted of 60% litter and 25% *Selaginella densa* for one stand sampled. The ground cover provided by mosses and lichens may also be significant.

This is a common herbaceous community within the monument and has a fairly consistent signature, both on true color and CIR aerial photos.

**Global Vegetation:** This grassland community is dominated by *Festuca arizonica* and *Muhlenbergia montana*. Open *Pinus ponderosa* woodlands with similar understory species composition often occur adjacent to this association. A few dwarf-shrubs may be present, particularly *Artemisia frigida*, *Chrysothamnus viscidiflorus*, and *Ericameria parryi*, but these species rarely exceed 5% foliar cover. Common graminoids and forbs present in lower abundance are *Bouteloua gracilis*, *Muhlenbergia filiculmis*, *Koeleria macrantha*, *Schizachyrium scoparium*, *Hymenoxys richardsonii*, *Antennaria parvifolia*, and *Arenaria fendleri*. *Festuca arizonica*, *Muhlenbergia montana*, and *Schizachyrium scoparium* are preferentially grazed and will be replaced by *Bouteloua gracilis*, *Artemisia frigida*, and *Hymenoxys richardsonii* with repeated heavy grazing.

**Global Dynamics:** Many occurrences have been degraded by heavy livestock grazing. *Festuca arizonica*, *Muhlenbergia montana*, and *Schizachyrium scoparium* are preferentially grazed and will be replaced by *Bouteloua gracilis*, *Artemisia frigida*, and *Hymenoxys richardsonii* with repeated heavy grazing. Much of the non-forested rangeland on the Rio Grande National Forest in Colorado (where the association is not uncommon) is considered to be in mid-seral stage or less. Some stands may have converted to nearly closed-canopy coniferous forests with fire suppression and/or heavy grazing.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i> , <i>Elymus elymoides</i> , <i>Koeleria macrantha</i>
Forb	<i>Heterotheca fulcrata</i> , <i>Oxytropis lambertii</i> , <i>Besseyia plantaginea</i> , <i>Antennaria parvifolia</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

*Festuca arizonica*-*Muhlenbergia filiculmis* (CEGL001605)

#### SYNONYMY:

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984)
- *Festuca arizonica*-*Muhlenbergia montana* (Bourgeron and Engelking 1994)

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G3.

**Global Classification Comments:** The classification is based on quantitative data from several classification and range analysis studies, and recent qualitative data.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Festuca arizonica* – *Muhlenbergia montana* Herbaceous Vegetation is the common grassland type within the monument. This type occupies flats, swales, hills, ridges, and slopes within the lower and middle elevations.

**Global Range:** The association is reported from Texas and southern Colorado, and possibly occurs in northern New Mexico with isolated localities in central New Mexico, and in northern and eastern Arizona.

**Nations:** US

**States/Provinces:** AZ? CO NM? TX

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 3

**Classification Confidence:** 1 **Identifier:** CEGL001606

**REFERENCES:** Bourgeron and Engelking 1994, Clary 1978, Currie 1975, Driscoll et al. 1984, Johnson 1953, Johnson 1956a, Johnson and Niederhof 1941, Johnson and Reid 1958, Johnson and Reid 1964, Johnston 1987, Komarkova 1986, Shanks 1977, Shepherd 1975, Smith 1967, Soil Conservation Service 1978, Stewart 1940, Trlica and Hackney 1977

## V.A.5.N.d.17. MUHLENBERGIA MONTANA HERBACEOUS ALLIANCE

### Mountain Muhly Herbaceous Alliance

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#### MUHLENBERGIA MONTANA - HESPEROSTIPA COMATA HERBACEOUS VEGETATION

##### Mountain Muhly - Needle-and-Thread Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association has been described from north-central and central Colorado, in the northeastern portion of the Roosevelt National Forest and Florissant Fossil Beds National Monument. The association may also occur in Rocky Mountain National Park in the Mummy Range. Sites where the association is found are typically xeric forest openings in the ponderosa pine zone, on south-facing slopes and ridgetops. Elevations range from 2286 to 2590 m (7500-8500 feet), and the slopes are moderately steep. Occasionally the association occupies rolling parklands. Strong, westerly winds probably result in removal of snow cover from the open sites and increased desiccation of plants. Soils are moderately deep Mollisols, with high coarse fragment content, sandy loam textures, and a distinct clay horizon. Parent materials are primarily colluvium of granitic and gneiss origins. Bare soil, exposed gravels, and small rocks account for as much as 30% of the ground surface area. This grassland association is strongly dominated by the perennial bunch grasses *Muhlenbergia montana* and *Hesperostipa comata* (= *Stipa comata*), averaging 11% and 22% cover, respectively. Several other graminoids are commonly present, including *Carex duriuscula* (= *Carex eleocharis*), *Pascopyrum smithii*, *Koeleria macrantha*, *Danthonia parryi*, *Muhlenbergia filiculmis*, and *Poa secunda*. Total graminoid cover averages 45%. Forb species are much less abundant, totaling <10% cover. The most important include *Allium geyeri*, *Antennaria rosea*, *Arenaria fendleri*, *Harbouria trachyleura*, *Mertensia lanceolata*, and *Penstemon secundiflorus*. Shrubs are absent or scarce, except for the suffrutescent *Artemisia frigida*, with 5% average cover. This association can be distinguished from *Muhlenbergia montana* Herbaceous Vegetation (CEGL001646) by the abundance to co-dominance of *Hesperostipa comata*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Only one dense stand of this herbaceous vegetation, covering approximately 200 m<sup>2</sup> on a Pikes Peak granite-derived gravel toeslope, was observed north of Boulder Creek. The remaining stands were smaller and less dense, not much more than patches, but in a similar topographic position, e.g., on toeslopes or ridges. The aspect ranged from 164° to 227 degrees, and the slopes are moderately steep, from 14–17%. Stands occur between approximately 8250 feet to 8450 feet in elevation within the Boulder Creek valley.

**Global Environment:** This type occurs in a mountainous region subject to a continental climate regime, with warm summers and cold winters. Precipitation patterns differ between the eastern and western sides of the Continental Divide, but the overall difference is warmer and drier winters on the east slope of the Front Range. Sites where found are typically xeric forest openings in the ponderosa pine zone, on south-facing slopes and ridgetops. Elevations range from 2286 to 2590 m (7500-8370 feet), and the slopes are moderately steep. Occasionally the association occupies rolling parklands. Strong, westerly winds probably result in removal of snow cover from the open sites and increased desiccation of plants. Parent materials are primarily colluvium of granitic and gneiss origins. Soils are moderately deep Mollisols, with high coarse-fragment content, sandy loam textures, and a distinct clay horizon. Bare soil, exposed gravels, and small rocks account for as much as 30% of the ground surface area.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** A small stand and patches of this herbaceous vegetation are present north of Boulder Creek, on toeslopes and midslopes of ridges and small hills. *Hesperostipa comata* is a medium-height bunchgrass, from 0.5–1.0 m tall and provides from 2–5% foliar cover in most patches. However, in one relatively dense stand, needle-and-thread provided approximately 30% foliar cover. Total foliar cover for this stand ranged from 55–70%, with most provided by grass species, particularly *Muhlenbergia montana*, *Bouteloua gracilis*, and *Muhlenbergia filiculmis* in addition to *Hesperostipa comata*. *Artemisia frigida* was present in one stand, at less than 5% foliar cover. Forb species common to the stand included *Geranium caespitosum* and *Grindelia subalpina*. The ground cover was evenly split between Pikes Peak granite-derived gravel and litter.

The small stand is well below the minimum mapping unit and resembles *Festuca arizonica* - *Muhlenbergia montana* stands on aerial photographs.

**Global Vegetation:** This grassland association is strongly dominated by the perennial bunch grasses *Muhlenbergia montana* and *Hesperostipa comata* (= *Stipa comata*), averaging 11% and 30% cover, respectively. Several other graminoids are commonly present, including *Carex duriuscula* (= *Carex eleocharis*), *Pascopyrum smithii*, *Koeleria macrantha*, *Danthonia parryi*, *Muhlenbergia filiculmis*, and *Poa secunda*. Total graminoid cover ranges from 55-70%. Forb species are much less abundant, totaling <10% cover. The most important include *Allium geyeri*, *Antennaria rosea*, *Arenaria fendleri*, *Harbouria trachypleura*, *Mertensia lanceolata*, *Geranium caespitosum*, *Grindelia subalpina*, and *Penstemon secundiflorus*. Shrubs are absent or scarce, except for the suffrutescent *Artemisia frigida*, with 5% average cover.

#### Global Dynamics:

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Hesperostipa comata</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>
Forb	<i>Geranium caespitosum</i> , <i>Grindelia subalpina</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Hesperostipa comata</i> , <i>Koeleria macrantha</i> , <i>Muhlenbergia montana</i> , <i>Pascopyrum smithii</i> <i>Poa secunda</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Hesperostipa comata</i> , <i>Muhlenbergia montana</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i> , <i>Carex inops</i> ssp. <i>heliophylla</i>
Forb	<i>Geranium caespitosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

*Muhlenbergia montana* - *Heterotheca villosa* Herbaceous Vegetation (CEGL002938)  
*Muhlenbergia montana* Herbaceous Vegetation (CEGL001646)

#### SYNONYMY:

- DRISCOLL FORMATION CODE: V.B.4.b. (Driscoll et al. 1984)
- *Muhlenbergia montana*-*Stipa comata* (Bourgeron and Engelking 1994)
- UNESCO FORMATION CODE: V.B.5b (UNESCO 1973)

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G1G2.

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** The *Muhlenbergia montana* - *Hesperostipa comata* Herbaceous Vegetation stand is extremely small and only observed on south-facing ridges and toeslopes along the north side of Boulder Creek, west of the Hornbek Homestead.

**Global Range:** Association described from north-central Colorado, primarily within the northern portion of the Front Range in Larimer County and farther south along the Front Range in Teller County.

**Nations:** US

**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 86

**Classification Confidence:** 2 **Identifier:** CEGLO01647

**REFERENCES:** Baumann 1978a, Bourgeron and Engelking 1994, Buttery 1955, Driscoll et al. 1984, Fish 1966, Hess 1981, Mutel 1976, UNESCO 1973

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### MUHLENBERGIA MONTANA HERBACEOUS VEGETATION

#### Mountain Muhly Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This plant association has been described from meadows in the mountains, plateaus and foothills of Colorado, Arizona and Utah. Sites are typically xeric forest openings or parks in the Ponderosa Pine zone with southern aspects on moderately steep slopes and ridgetops. Occasionally the stands occupy rolling parklands or volcanic cinder fields. The xeric nature of sites appears to be an important environmental factor. Substrates are shallow to moderately deep, rocky, sand to sandy loam-textured soils. Bare soil, exposed gravels, and small rocks account for as much as 50% of the ground surface area. The vegetation is characterized by a moderately dense herbaceous layer that is typically dominated by the warm-season, perennial bunchgrass *Muhlenbergia montana*, but may be codominated by *Blepharoneuron tricholepis* or *Trisetum spicatum* (= *Trisetum montanum*) (in New Mexico). The typically sparse forb layer often consists of *Allium geyeri*, *Antennaria rosea*, *Arenaria fendleri*, *Eriogonum umbellatum*, *Heterotheca villosa*, and *Phlox diffusa*. Except for the abundant dwarf-shrub *Artemisia frigida*, scattered *Ericameria nauseosa* shrub, or occasional *Pinus ponderosa* trees, woody species are very sparse or absent. The exotic grasses *Poa pratensis* and *Bromus tectorum* are common in some of these stands. Diagnostic of this grassland association is the dominance of *Muhlenbergia montana* in the herbaceous layer and low cover of *Festuca arizonica*. This association can be distinguished from *Muhlenbergia montana* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001647) by the very low cover or lack of *Hesperostipa comata*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Soils are typically thin consisting of Pikes Peak granite gravel on relatively steep slopes. A few stands formed in deeper soils, to 10 cm thick along the middle slopes of small drainages, these stands contained small amounts of *Hesperostipa comata*. This bunchgrass grassland typically occupies middle and upper slopes of hills and ridges within the monument. The aspects ranged from 155 (SE) --227 (SW) degrees.

**Global Environment:** This plant association has been described from meadows in the mountains, plateaus and foothills of Colorado, Arizona and Utah. Elevation ranges from 2300-2800 m (7540-9200 feet). Sites are typically xeric forest openings or parks in the Ponderosa Pine zone with southern aspects on moderately steep slopes and ridgetops. Occasionally the stands occupy rolling parklands or volcanic cinder fields. The xeric nature of sites appears to be an important environmental factor. Substrates are shallow to moderate deep, rocky, sand to sandy loam textured soils sometimes with a distinct clay horizon. Parent materials are primarily colluvium derived from granite and gneiss or cinder. Bare soil, exposed gravels, and small rocks account for as much as 50% of the ground surface area.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation is present on the slopes of hills and ridges, and to a lesser extent adjacent to small drainages in the monument. It is associated with a few dwarf-shrubs in the type, particularly *Artemisia frigida*, that rarely exceeds 5% foliar cover. The dominant and common graminoids include *Muhlenbergia montana*, *Festuca arizonica*, *Muhlenbergia filiculmis*, *Bouteloua gracilis*, *Elymus elymoides*, and *Koeleria macrantha*. The foliar cover estimated for graminoids ranged from approximately 25% to as much as 40%. Forbs are diverse within this association but typically provide less than 5% foliar cover. The more common forb species include *Heterotheca fulcrata* (= *Chrysopsis fulcrata*), *Orthocarpus luteus*, *Geranium caespitosum*, and *Antennaria parvifolia*. Ground cover consisted of 55–95% litter and approximately 40% gravel for most stands sampled. The ground cover provided by mosses and lichens may be significant, ranging from 5–35%.

This is one of the less common herbaceous communities within the monument but has a fairly consistent signature, both on true color and CIR aerial photos.

**Global Vegetation:** This association is characterized by a moderately dense herbaceous layer that is typically dominated by the warm-season, perennial bunchgrass *Muhlenbergia montana*, but may be codominated by *Blepharoneuron tricholepis* or *Trisetum spicatum* (= *Trisetum montanum*) (in New Mexico). Other associated graminoids include *Bouteloua curtipendula*, *Bouteloua gracilis*, *Carex duriuscula* (= *Carex eleocharis*), *Danthonia parryi*, *Elymus albicans* (= *Elymus lanceolatus* ssp. *albicans*), *Festuca brachyphylla*, *Festuca arizonica*, *Hesperostipa comata*, *Koeleria macrantha*, *Muhlenbergia filiculmis*, *Pascopyrum smithii*, *Poa secunda*, and *Schizachyrium scoparium*. The typically sparse forb layer often consists of *Allium geyeri*, *Antennaria rosea*, *Arenaria fendleri*, *Eriogonum umbellatum*, *Harbouria trachypleura*, *Heterotheca villosa*, *Mertensia lanceolata*, *Opuntia polyacantha*, *Penstemon secundiflorus*, and *Phlox diffusa*. Except for the abundant dwarf-shrub *Artemisia frigida*, scattered *Ericameria nauseosa* shrubs, or occasional *Pinus ponderosa* trees, woody species are very sparse or absent. The exotic grasses *Poa pratensis* and *Bromus tectorum* are common in some of these stands. Diagnostic of this grassland association is the dominance of *Muhlenbergia montana* in the herbaceous layer and low cover of *Festuca arizonica*.

**Global Dynamics:** *Muhlenbergia montana* often grows in association with montane conifer forests, especially ones dominated by *Pinus ponderosa*, and has developed a tolerance for relatively frequent fire regimes. Although *Muhlenbergia montana* resprouts after burning, it may take a few years to recover to pre-burn density (Fischer and Bradley 1987). These grasslands may be considered seral or an edaphic climax depending on whether there are environmental factors, such as aridity, that are preventing establishment of trees. Historically, much of the area where this association occurs was heavily grazed by livestock, primarily sheep and cattle (Shepherd 1975). Season of use is important in stands with both *Hesperostipa comata* and *Muhlenbergia montana*; fall grazing will favor *Hesperostipa comata* over the later-blooming *Muhlenbergia montana* (Clary 1978). The reverse is true if grazing is always limited to summer. Overgrazing will reduce or eliminate *Hesperostipa comata*, *Muhlenbergia montana*, and the other palatable species, leaving the more grazing-tolerant *Bouteloua gracilis* and less palatable plants such as *Hymenoxys*, *Artemisia* and *Chrysothamnus* species to dominate the site Clary (1978).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Muhlenbergia montana</i> , <i>Blepharoneuron tricholepis</i> , <i>Trisetum spicatum</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Muhlenbergia montana</i> , <i>Festuca arizonica</i> , <i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>
Forb	<i>Elymus elymoides</i> , <i>Koeleria macrantha</i>
	<i>Heterotheca fulcrata</i> , <i>Orthocarpus luteus</i> , <i>Antennaria parvifolia</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Muhlenbergia montana</i> , <i>Blepharoneuron tricholepis</i> , <i>Trisetum spicatum</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

##### Global

<u>Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

- Festuca arizonica* - *Muhlenbergia montana* Herbaceous Vegetation (CEGL001606)
- Muhlenbergia montana* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001647)
- Muhlenbergia montana* - *Heterotheca villosa* Herbaceous Vegetation (CEGL002938)

#### SYNONYMY:

- DRISCOLL FORMATION CODE:V.B.4.b. (Driscoll et al. 1984) B



- *Muhlenbergia montana* (Bourgeron and Engelking 1994) =
- *Bouteloua gracilis*-*Muhlenbergia montana*-*Poa* (Loveless 1967)
- *Muhlenbergia montana*/*Blepharoneuron tricholepis* Plant association (Johnston 1987)
- Kaibab Basin and Dry Park Meadows (Merkle 1962)
- *Muhlenbergia*-*Comandra* and *Muhlenbergia*-*Aragallus* Societies (Ramaley 1916a)
- *Muhlenbergia*-*Comandra* and *Muhlenbergia*-*Aragallus* Societies Ramaley 1916b
- Rangeland Group H68 (Shanks 1977)

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G3G4.

**Global Classification Comments:** Diagnostic of this grassland association is the dominance of *Muhlenbergia montana* in the herbaceous layer and low cover of *Festuca arizonica*. This association can be distinguished from *Muhlenbergia montana* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001647) by the very low cover or lack of *Hesperostipa comata*.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Muhlenbergia montana* Herbaceous Vegetation is present within the monument, occupying lower and middle slopes along small drainages within the lower to mid-elevations.

**Global Range:** This plant association forms meadows in the mountains and foothills of Colorado, Arizona and Utah.

**Nations:** US

**States/Provinces:** AZ CO UT

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 52, 71

**Classification Confidence:** 2 **Identifier:** CEGL001646

**REFERENCES:** Bourgeron and Engelking 1994, Clary 1978, Driscoll et al. 1984, Fischer and Bradley 1987, Loveless 1963, Loveless 1967, McIntosh 1923, Merkle 1962, Ramaley 1915, Ramaley 1916a, Ramaley 1916b, Reid 1974, Shanks 1977, Shepherd 1975, Terwillinger et al. 1979b, USFS 1983b

### V.A.5.N.e. Short sod temperate or subpolar grassland

#### V.A.5.N.e.15. MUHLENBERGIA FILICULMIS HERBACEOUS ALLIANCE

Slim-stem Muhly Herbaceous Alliance

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#### MUHLENBERGIA FILICULMIS HERBACEOUS VEGETATION

Slim-stem Muhly Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association occurs in Colorado on xeric grassland sites of higher elevations (2700-3085 m, 8860-10,120 feet) in areas of scant rainfall. In the San Juan Mountains and Rampart Ranges, it occurs primarily on volcanically derived soils, and on the Rio Grande River it is found on alluvial benches. In the San Juan Mountains, Tertiary volcanic rocks overlying Precambrian crystalline and sedimentary rocks are the predominant parent materials and surface rocks for this association. Fifty percent or more of the ground surface can be exposed rock. The dominant species, *Muhlenbergia filiculmis*, tends to form rings or cushions averaging 2-8 inches or more in diameter. In Florissant Fossil Beds National Monument, this grassland is observed to occur in rings or ovals on ridge and hilltops. *Bouteloua gracilis* is abundant, and several other grasses, including *Festuca arizonica* and *Koeleria macrantha*, are found in scattered patches. Commonly associated forbs include *Artemisia frigida*, *Hymenoxys richardsonii*, and *Arenaria fendleri*. Drier sites within the association tend to have an even greater abundance of *Muhlenbergia filiculmis* than more mesic sites. *Festuca arizonica* - *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001605) occurs in the same area but on steeper more south-facing slopes, and has a much higher amount of *Festuca arizonica*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This herbaceous vegetation occupies the tops of ridges and hills within more extensive *Festuca arizonica* - *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001605) and *Festuca arizonica* - *Muhlenbergia montana* Herbaceous Vegetation (CEGL001606). These sites are nearly flat (1-3% slopes) and generally lie on eastern or southern exposures. It is likely that less moisture is available on the ridges and hills to support the more robust bunch grasses of the more common types on

deeper soils. The soils are composed of silty clay and small gravel that are also encrusted with lichens and mosses. Runoff is rapid, and evaporation is high from these sites.

**Global Environment:** Found in a region of high-elevation (>2130 m, 7000 feet), intermountain parks and Front Range foothills, surrounded by montane and subalpine forest slopes. In general, these parks are dominated by grasslands. In Florissant National Monument, it occurs in small patches, roughly circular in shape on hilltops and ellipsoid on ridges. The region has a semi-arid to arid, continental climate. Average annual precipitation is low, <10 inches, with a summer peak in July and August. January is the coldest and driest month, and April is the month of greatest snow accumulation. The region is often subjected to strong northerly and westerly winds, which can remove snow cover and subject plants to severe desiccation. This association is found from 2560 to 2930 m (8400-9700 feet) elevation, on slopes with southerly to southwest aspects. Slopes vary from gentle to somewhat steep, and rocks or boulders can be abundant, especially on steeper slopes. Soils are derived from volcanic parent materials, and are dry, well-drained, shallow and coarse-textured (sandy and gravelly). The ground surface is generally bare soil (35% to 40% cover), with rocks common.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation occurs in small patches, roughly circular in shape on hilltops and ellipsoid on ridges. The dominant vegetation is very short, typically less than 10 cm tall. The association is dominated by *Muhlenbergia filiculmis*, *Bouteloua gracilis*, and *Festuca arizonica*, which provide approximately 40% foliar cover. Other graminoids common to this type include *Koeleria macrantha*, *Elymus elymoides*, and *Carex inops* ssp. *heliophila*. Forb species are diverse and typically provide approximately 20–30% foliar cover. The more common forb species include *Hymenoxys richardsonii*, *Geranium caespitosum*, *Antennaria* sp., *Cryptantha thyrsoiflora*, and the dwarf-shrub *Artemisia frigida*. Lichens and mosses are common to this type and provide from 20% to as much as 65% ground cover. The litter layer is variable and covers from as little as 25% to as much as 65% of the ground surface.

The stands of this herbaceous vegetation are typically small and round or narrow, and are likely to be below the minimum mapping unit for the project (0.5 ha). Their topographic position and height would make them distinguishable during interpretation of true color or CIR photographs.

**Global Vegetation:** This is a grassland association, dominated by a perennial sod grass *Muhlenbergia filiculmis*, typically short in stature (<0.5 m height). Other associated grasses include *Bouteloua gracilis*, *Festuca arizonica*, *Koeleria macrantha*, *Elymus elymoides*, and the perennial sedges *Carex obtusata* and *Carex inops* ssp. *heliophila*. Total graminoid cover averages 23%, but can be as high as 40%. Perennial forbs are not typically abundant. Dwarf shrub and forb species can include *Artemisia frigida*, *Hymenoxys richardsonii*, *Eriogonum umbellatum*, *Arenaria fendleri*, *Geranium caespitosum*, *Antennaria* sp., *Cryptantha thyrsoiflora*, and *Castilleja integra*. Total forb cover averages 4%. In Florissant Fossil Beds National Monument, forb cover was 20-30%. A sparse shrub layer is occasionally present (averaging 4% cover), composed primarily of the evergreen species *Ericameria nauseosa* (= *Chrysothamnus nauseosus*) and *Ericameria parryi* (= *Chrysothamnus parryi*). Lichens are typically common, with 3% to over 9% (and as high as 65% in Florissant Fossil Beds NM) cover of the ground surface.

**Global Dynamics:** Wind and fire are likely the driving disturbances maintaining these grasslands. Wind blows away any winter snow accumulation, keeping sites dry. Periodic fires maintain the open structure by killing invading conifer seedlings. *Hymenoxys richardsonii*, *Artemisia frigida*, and *Lappula occidentalis* are known to increase in abundance in this grassland while *Muhlenbergia filiculmis* decreases with persistent overgrazing. High-quality stands will have no to very low cover of these forbs and abundant *Muhlenbergia filiculmis*. *Festuca arizonica* appears to do better in more protected or mesic areas.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i>
Forb	<i>Hymenoxys richardsonii</i> , <i>Geranium caespitosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bouteloua gracilis</i> , <i>Muhlenbergia filiculmis</i>
Forb	<i>Artemisia frigida</i> , <i>Hymenoxys richardsonii</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Muhlenbergia filiculmis</i> , <i>Bouteloua gracilis</i> , <i>Festuca arizonica</i> , <i>Carex inops</i> ssp. <i>heliophila</i>
Forb	<i>Hymenoxys richardsonii</i> , <i>Geranium caespitosum</i> , <i>Artemisia frigida</i>

**Global**

**Stratum**

Graminoid

**Species**

*Muhlenbergia filiculmis*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

*Festuca arizonica* - *Muhlenbergia filiculmis* Herbaceous Vegetation (CEGL001605) occurs in the same area but on steeper, more south-facing slopes and has a much higher amount of *Festuca arizonica*.

**SYNONYMY:**

- DRISCOLL FORMATION CODE: V.C.5.a. (Driscoll et al. 1984)
- *Muhlenbergia filiculmis* (Bourgeron and Engelking 1994)
- UNESCO FORMATION CODE: V.C.7a (UNESCO 1973)

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G2.

**Global Classification Comments:**

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Muhlenbergia filiculmis* Herbaceous Vegetation occupies south- and west-facing dry hilltops, ridgetops, and some dry slopes within the lower to middle elevations of the monument.

**Global Range:** This association is known only from Mineral, Saguache, and Teller counties, Colorado. It has only been found in the northeastern slopes of the San Juan Mountains, the margins of the San Luis Valley, on the plateaus of the Trickle Mountain area in the Cochetopa Hills, and on dry ridgetops and hilltops in Florissant Fossil Beds National Monument.

**Nations:** US

**States/Provinces:** CO

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plot 58

**Classification Confidence:** 2 **Identifier:** CEGL001780

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Ramaley 1942, Shepherd 1975, Stewart 1940, UNESCO 1973

**V.A.5.N.h. Short alpine or subalpine dry bunch grassland**

**V.A.5.N.h.5. DANTHONIA PARRYI HERBACEOUS ALLIANCE**

Parry's Oatgrass Herbaceous Alliance

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**DANTHONIA PARRYI HERBACEOUS VEGETATION**

Parry's Oatgrass Herbaceous Vegetation

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This plant association most commonly occurs in forest openings, in montane meadows or parks in the Colorado Rocky Mountains and in adjacent parts of Wyoming. Stands occur from 2260-3350 m (7400-11,000 feet) in elevation. The soils are more moist than those of adjacent grasslands dominated by *Festuca arizonica* and are composed of a silty clay with granitic gravel. Stands are usually less than 50 acres, but occasionally are reported to be up to 600 acres in size. Ungrazed or lightly grazed stands of this association are characterized by dense stands of *Danthonia parryi*. Other common species include *Festuca arizonica*, *Festuca idahoensis*, *Koeleria macrantha*, *Muhlenbergia montana*, *Poa pratensis*, *Elymus trachycaulus* and *Carex inops ssp. heliophila*. *Muhlenbergia montana* may be more abundant on drier sites or those impacted by livestock grazing.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** This native bunchgrass forms nearly pure stands on moist soils of the middle and higher elevations (8400–8600 feet) within the monument. This herbaceous vegetation is distributed predominantly on north- and northwest-facing exposures on slopes, in narrow mesic drainages, and on hilltops where mesic conditions occur. Stands occupy bands 10-25 m wide at the base of mesic forests, and forms a broad understory in relatively open, mesic woodlands composed primarily of *Pseudotsuga menziesii*, *Populus tremuloides*, and *Pinus ponderosa*. *Danthonia parryi* persists following invasion by tree species as a dense to sparse understory, dependent on the age of the stand and amount of canopy closure.

**Global Environment:** Stands occur from 2260-3350 m (7400-11,000 feet) in elevation, in forest openings, montane meadows and parks. The soils are more moist than those of adjacent grasslands dominated by *Festuca arizonica* and are composed of a silty clay with granitic gravel.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation is characterized by strong dominance of *Danthonia parryi*, but good species diversity exists within stands. It is a relatively short grassland type, less than 0.5 m in height, and the foliar cover ranges from 60-90%. The ground cover consists of dense litter ranging from 95-100% cover and up to 5 cm thick. Commonly associated graminoids are other bunch grasses, including *Festuca arizonica*, *Muhlenbergia montana*, and *Bromus porteri*. For some stands, *Bromus porteri* is relatively dense on the outer, drier edge of the stand, providing an ecotone with *Festuca arizonica* grassland types. Forbs are also common in these stands, particularly *Besseyia plantaginea*, *Achillea millefolium* var. *occidentalis* (= *Achillea lanulosa*), and *Geum macrophyllum*. These stands range from approximately 0.25 hectare to over 10 hectares in size. The soils are more moist than those of adjacent grasslands dominated by *Festuca arizonica* or the exotic *Bromus inermis* and are composed of a silty clay among small Pikes Peak granite gravel. It appears that in the absence of fire, this herbaceous vegetation is invaded by *Picea pungens*, *Pseudotsuga menziesii*, and *Pinus ponderosa* trees.

This type has a distinct signature on CIR aerial photography with a smooth, pink color located next to very tall stands of mesic forest species. On true color aerial photography, the signature is a dark grayish brown.

**Global Vegetation:** Ungrazed or lightly grazed stands of this association are characterized by dense stands of *Danthonia parryi*. Other common species include *Festuca arizonica*, *Festuca idahoensis*, *Koeleria macrantha*, *Muhlenbergia montana*, *Poa pratensis*, *Poa secunda*, *Poa fendleriana*, *Elymus trachycaulus*, and *Carex inops* ssp. *heliophila*. *Muhlenbergia montana* may be more abundant on drier sites or those impacted by livestock grazing. Forbs are diverse but contribute little cover (usually less than 10%) and include *Besseyia plantaginea*, *Achillea millefolium* var. *occidentalis* (= *Achillea lanulosa*), *Geum macrophyllum*, *Antennaria rosea*, *Eriogonum umbellatum*, *Gaillardia aristata*, *Gentiana* spp., *Mertensia lanceolata*, *Penstemon* spp., and *Potentilla hippiana*. The dwarf-shrub *Artemisia frigida* is often scattered through these stands.

**Global Dynamics:** Fire has been suggested as a management tool in some cases where pine is encroaching into the grassland meadows. *Danthonia parryi* is considered to be very palatable to livestock, and overgrazing has been reported in some stands which reduces the abundance of *Danthonia parryi*.

## MOST ABUNDANT SPECIES

### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Danthonia parryi</i> , <i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Bromus porteri</i>
Forb	<i>Besseyia plantaginea</i> , <i>Achillea millefolium</i> , <i>Geum macrophyllum</i>

### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Danthonia parryi</i> , <i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Bromus porteri</i>
Forb	<i>Besseyia plantaginea</i> , <i>Achillea millefolium</i> , <i>Geum macrophyllum</i>

## CHARACTERISTIC SPECIES

### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Danthonia parryi</i> , <i>Festuca arizonica</i> , <i>Muhlenbergia montana</i> , <i>Bromus porteri</i>
Forb	<i>Besseyia plantaginea</i> , <i>Achillea millefolium</i> , <i>Geum macrophyllum</i>

**Global**

**Stratum**

Graminoid

Forb

**Species**

*Danthonia parryi*, *Festuca arizonica*, *Muhlenbergia montana*, *Bromus porteri*

*Besseyia plantaginea*, *Achillea millefolium*, *Geum macrophyllum*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**SYNONYMY:**

- DRISCOLL FORMATION CODE: V.C.5.b. (Driscoll et al. 1984)
- *Danthonia parryi* (Bourgeron and Engelking 1994)

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G3.

**Global Classification Comments:** The classification is based on plot data and recently collected qualitative data. *Danthonia parryi* is reported to form dense communities on windy slopes and ridges in Canada but no data were presented. It is not understood how this plant community reported in Canada may relate to the *Danthonia parryi* plant association in Colorado and Wyoming.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** This is an association of moist soils, located on predominantly north- and northwest-facing slopes, and growing in a band adjacent to *Picea pungens*, *Pseudotsuga menziesii*, and *Populus tremuloides* forest stands. These sites receive additional moisture due to accumulation of snowfall and are shaded for at least a portion of the day by the tall trees, often in excess of 30 m in height. Stands of *Danthonia parryi* are distributed at the middle to higher elevations of the monument.

**Global Range:** This association is reported from the southern Rocky Mountains in Colorado, mainly from the South Platte, Arkansas, and Rio Grande River drainages, but with a few reports from the Colorado River drainage. The association also occurs in southern Wyoming.

**Nations:** US

**States/Provinces:** CO WY

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 29, 50, 51

**Classification Confidence:** 1 **Identifier:** CEG001795

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Hess 1981, Looman 1983, Reid and Love 1951, Robbins 1918, Ueckert 1968.

**V.A.5.N.k. Seasonally flooded temperate or subpolar grassland**

**V.A.5.N.k.42. CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE**

(Swollen-beak Sedge, Beaked Sedge) Seasonally Flooded Herbaceous Alliance

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**CAREX UTRICULATA HERBACEOUS VEGETATION**

Beaked Sedge Herbaceous Vegetation

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This wetland association is found throughout much of the western U.S. Stands occur in montane and subalpine areas around the edges of lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains. Sites are flat to undulating, often with a hummocky microtopography. The water table is usually near the surface for most of the growing season. There are a wide variety of soil types for this association ranging from saturated organics or fine silty clays to clays over cobbles and alluvium to fine-loamy and sandy-skeletal. Mottling often

occurs near the surface because of the high water table. The vegetation is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex utriculata* (20-99% cover). Stands often appear to be nearly pure *Carex utriculata*, but a variety of other graminoid species may be present as well. Other *Carex* species present include *Carex lenticularis*, *Carex aquatilis*, and *Carex microptera*, but usually with low cover. Other graminoid species that may be present include *Calamagrostis canadensis*, *Glyceria striata*, and *Juncus balticus*. Sparse forb cover can include *Geum macrophyllum*, *Mentha arvensis*, and *Mimulus guttatus*. Scattered *Salix* spp. shrubs may be present because these riparian shrublands are often adjacent. *Salix* species vary depending on elevation and geography. It is distinguished from *Carex aquatilis* – *Carex utriculata* Herbaceous Vegetation (CEGL001803) by the dominance of *Carex utriculata*. *Carex aquatilis*, if present, is not more than 1/3 of the total cover.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This herbaceous vegetation occupies the saturated to inundated zone adjacent to flowing streams and on groundwater swells, where groundwater collects under vegetation and elevates it, creating a quaking bog. The elevation of these drainages lies between 8250-8600 feet.

**Global Environment:** This wetland association is found throughout much of the western U.S. Elevation ranges from 1060-2950 m (3500-9680 feet). Stands occur in montane and subalpine areas around the edges of lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains (Kittel et al. 1999). Sites are flat to undulating, often with a hummocky microtopography (Kovalchik 1993). The water table is usually near the surface for most of the growing season. There are a wide variety of soil types for this association ranging from saturated organics or fine silty clays to clays over cobbles and alluvium to fine-loamy and sandy-skeletal. Mottling and gleying often occur near the surface because of the high water table.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation occurs as nearly monotypic stands with *Carex utriculata* providing from 70–90% of the foliar cover. Beaked sedge is tall, from 0.5–1.0 m high, and typically grows from 100% litter ground cover that is up to 10 cm deep. The litter layer is often riddled with small mammal tunnels. Associated species rarely provide more than 5% foliar cover and include *Carex aquatilis*, *Juncus balticus*, *Deschampsia caespitosa*, *Rumex aquaticus*, *Galium trifidum*, *Mentha arvensis*, and *Lemna minor*, a floating aquatic species present in small standing water pockets.

This herbaceous vegetation is very similar and probably indistinguishable from *Carex aquatilis* Herbaceous Vegetation (CEGL001802) when interpreting true color and CIR aerial photographs.

**Global Vegetation:** This plant association is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex utriculata* (20-99% cover). Stands often appear to be nearly pure *Carex utriculata*, but a variety of other graminoid species may be present as well. Other *Carex* species present include *Carex aquatilis*, *Carex lenticularis*, *Carex microptera*, *Carex nebrascensis*, and *Carex scopulorum*, but usually with low cover. Other graminoid species that may be present include *Calamagrostis canadensis*, *Deschampsia caespitosa*, *Glyceria striata*, and *Juncus balticus*. Sparse forb cover may include *Epilobium* spp., *Geum macrophyllum*, *Mentha arvensis*, *Mimulus guttatus*, *Polemonium occidentale*, *Galium trifidum*, and *Lemna minor*, a floating aquatic species. Scattered *Salix* spp. shrubs may be present because these riparian shrublands are often adjacent. *Salix* species vary depending on elevation and geography. *Salix monticola*, *Salix drummondiana*, *Salix geyeriana*, *Salix planifolia*, and *Salix exigua* are common species.

**Global Dynamics:** *Carex utriculata* is a widespread species that colonizes recently formed pond edges and seasonally flooded areas near streams. Once established it is long-lived and will dominate sites unless disturbed with changes in site hydrology. Soil development (over time) may decrease soil moisture and allow other species to replace it (Manning and Padgett 1995).

#### MOST ABUNDANT SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Carex utriculata</i> , <i>Carex aquatilis</i> , <i>Juncus balticus</i>
Forb	<i>Rumex aquaticus</i> , <i>Galium trifidum</i>

**Global**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Carex utriculata</i>

## CHARACTERISTIC SPECIES

### Florissant Fossil Beds NM

#### Stratum

#### Species

Graminoid

*Carex utriculata*, *Carex aquatilis*, *Juncus balticus*

Forb

*Rumex aquaticus*, *Galium trifidum*

### Global

#### Stratum

#### Species

Graminoid

*Carex utriculata*

## OTHER NOTEWORTHY SPECIES

### Florissant Fossil Beds NM

### Global

#### Stratum

#### Species

## GLOBAL SIMILAR ASSOCIATIONS:

*Carex aquatilis* – *Carex utriculata* Herbaceous Vegetation (CEGL001803)

## SYNONYMY:

- DRISCOLL FORMATION CODE:V.B.4.a. (Driscoll et al. 1984) B
- *Carex rostrata* (Bourgeron and Engelking 1994) =
- Wet Meadows (Andrews 1983) B
- *Carex rostrata* Association (Benedict 1983) =
- *Carex rossii* community (Franklin and Dyrness 1973) =
- *Carex rostrata* Habitat Type (Hall and Hansen 1997) B
- *Carex rostrata* Habitat Type (Hansen et al. 1995) B
- *Carex utriculata* Herbaceous Vegetation (Kittel et al. 1996) =
- *Carex utriculata* Herbaceous Vegetation (Kittel et al. 1999) =
- Beaked Sedge Association (Kovalchik 1987) =
- *Carex utriculata* Association (Kovalchik 1993) =
- *Carex rostrata* Community Type (Manning and Padgett 1995) =
- *Carex rostrata* Habitat Type, *Carex rostrata* Phase (Mattson 1984) =
- *Carex rostrata* Community Type (Mutel 1973)
- Natural Wet Meadows (Mutel 1976) B
- *Carex rostrata* Transitions Community Type (Mutz and Graham 1982) B
- *Carisetum rostratae* Association (Nachlinger 1985) =
- *Carex rostrata* Community Type (Norton et al. 1981)
- *Carex rostrata* Community Type (Padgett et al. 1988b) =
- *Carex rostrata* Community Type (Padgett et al. 1989) =
- *Carex rostrata*-*Carex aquatilis* Community Type (Tuhy and Jensen 1982) B
- *Carex rostrata* Community Type (Youngblood et al. 1985a)
- *Carex rostrata* Community Type (Youngblood et al. 1985b)

## GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G5.

**Global Classification Comments:** *Carex rostrata* var. *utriculata* (Boott) Bailey was recognized as a distinct species from *Carex rostrata* Stokes and named *Carex utriculata* Boott (Kartesz 1999). This taxonomic change has led to confusion in some of the earlier vegetation classification literature because no distinction was made between the subspecies. However, *Carex utriculata* Herbaceous Vegetation (CEGL001562) is known only from the western U.S. and, according to Kartesz (1999), *Carex rostrata* is reported from only Montana, Idaho, and Washington in the western U.S., and for now, *Carex rostrata* communities are known only from the midwestern U.S. and Canada. Additional survey work will help clarify this.

## ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Carex utriculata* Herbaceous Vegetation occupies the area immediately adjacent (first terrace) to the flowing water of Grape and Boulder creeks and their tributary drainages. These are low-gradient sites of 2% or less and the aspect is that of the stream or drainage.

**Global Range:** This wetland association is found at montane and subalpine elevations throughout much of the western U.S.

**Nations:** US

**States/Provinces:** AZ? CA CO ID MT NM NV OR UT WA WY

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots: 7, 10, 11, 41, 78

**Classification Confidence:** 1 **Identifier:** CEGLO01562

**REFERENCES:** Andrews 1983, Baker 1983a, Benedict 1983, Bourgeron and Engelking 1994, Driscoll et al. 1984, Franklin and Dyrness 1973, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Kartesz 1999, Kerr and Henderson 1979, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kovalchik 1987, Kovalchik 1993, Looman 1982, Mattson 1984, Mutel 1973, Mutel 1976, Mutel and Marr 1973, Mutz and Graham 1982, Mutz and Queiroz 1983, Nachlinger 1985, Norton et al. 1981, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley and Robbins 1909, Schlatterer 1972, Seyer 1979, Tuhy 1981, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

### V.A.5.N.k.43. CAREX AQUATILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE

Aquatic Sedge Seasonally Flooded Herbaceous Alliance

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#### CAREX AQUATILIS HERBACEOUS VEGETATION

Aquatic Sedge Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This common, widespread herbaceous vegetation occurs as large, mesic meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations throughout the western U.S. It occurs in a variety of environmental settings in the montane and subalpine zones. Some of the largest expanses occur in broad, low-gradient valleys where large snowmelt-fed swales and slopes dominate the landscape. It can also grow in fine sediments at the margins of lakes and beaver ponds. Presence of *Carex aquatilis* typically indicates wet soils with high organic matter or histic epipedons. A clear dominance by *Carex aquatilis* and low cover of *Carex utriculata* or *Pedicularis groenlandica* sets this plant association apart from closely related types.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This herbaceous vegetation occupies low-gradient sites (from 1–4% slopes) along streams where the soil (peat formation is typically present) is saturated to the surface or shallow standing water is present. The aspect is that of the stream, normally, so most exposures are to the north and west. The distribution of *Carex aquatilis* is zonal, with *Carex utriculata* occupying the most inundated sites immediately adjacent to the drainage and *Juncus balticus* occupying the drier margin at the higher elevation. There are ecotones formed at both zone margins and can be quite broad.

**Global Environment:** This plant association occurs in a variety of valley types, but the largest expanses occur in broad, low-gradient valleys where large snowmelt-fed swales and slopes dominate the landscape. It can also grow in fine sediments at the margins of lakes and beaver ponds. Presence of at least 25% cover of *Carex aquatilis* typically indicates wet soils with high organic matter or histic epipedons.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Total foliar cover in these stands typically exceeded 70% to approximately 80%, for graminoids between 0.5–1.0 m tall. Most of the foliar cover was attributable to *Carex aquatilis*, and small amounts of foliar cover, typically 2–3%, was contributed by *Carex utriculata*, *Juncus balticus*, *Deschampsia caespitosa*, *Hordeum brachyantherum*, and *Poa pratensis* as associated graminoids. The forbs that occupy these stands also provide less than 2–3% foliar cover and include *Rumex aquaticus*, *Mentha arvensis*, *Potentilla plattensis*, *Chamerion angustifolium ssp. circumvagum*, and the exotic *Cirsium arvense*. Ground cover consists entirely of litter, typically up to 10 cm thick. There are many small mammal tunnels through the bed of litter. Some of these sites are underlain by peat and may “quake” when walked upon.



The aerial photo signatures for stands of this herbaceous vegetation are similar to those for *Carex utriculata* and *Juncus balticus*. It may not be possible to separate the dark green to black color that appears on true color aerial photos and the pink to red color of CIR photography.

**Global Vegetation:** This plant association is characterized by a dense rhizomatous meadow of *Carex aquatilis* (10-80% cover), usually accompanied by a few other graminoids species such as *Calamagrostis canadensis* (1-40%) or *Deschampsia caespitosa* (1-16%). *Eleocharis quinqueflora* can be abundant on organic substrates (1-49% cover) at high elevations. *Carex utriculata* (1-20% cover) may be present. When present, *Carex utriculata* is usually not more than one-third the cover of *Carex aquatilis* cover. If it is more than that, the stand may be classified as *Carex aquatilis* - *Carex utriculata* Herbaceous Vegetation (CEGL001803) or *Carex utriculata* Herbaceous Vegetation (CEGL001562). Forbs are often present, although sometimes inconspicuous (generally <10%, but can be as high as 40%). Species include *Epilobium* spp., *Pedicularis groenlandica*, *Caltha leptosepala*, *Cardamine cordifolia*, and *Mertensia ciliata*.

**Global Dynamics:** Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of root structure. The wet and often saturated soils of this plant association are also vulnerable to compaction by livestock and heavy equipment. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen et al. 1995).

Deferred and rest rotation grazing systems are recommended for maintaining the vigor and productivity of this plant association. Rest periods are recommended in order to provide time for plant establishment. Late summer and fall grazing is not recommended because if there are adjacent willows, they are vulnerable to pruning damage due to limited regrowth before the end of the growing season (Hansen et al. 1995, Kovalchik and Elmore 1992).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Beaver dams aid in controlling channel downcutting, streambank erosion, and downstream movement of sediment. Beaver dams raise the water table and provide water for hydrophytic plants including willows and sedges. The trapping of sediment behind beaver dams, along with plant reproduction, raises the channel bed and creates a wetland environment. Land managers should consider maintaining beaver activity in an area versus their removal (Hansen et al. 1995).

Burning of this plant association temporarily increases the productivity of *Carex utriculata* and *Carex aquatilis*. However, livestock grazing needs to be eliminated for the year prior to burning and for at least 2-3 years after burning. This is necessary in order to keep livestock from damaging young, palatable regrowth and to allow for root reserve build up. Prescribed burning is also an effective method of rejuvenating decadent clumps of willows. The willow species in this plant association vigorously sprout following quick, hot fires. Slow-burning fires can actually damage the plants (Hansen et al. 1995).

Presence of *Carex utriculata* may indicate that the site has progressed from the more wet *Carex utriculata* community to the current less mesic conditions, and may become dominated by *Salix planifolia* or *Salix wolfii* (Youngblood et al. 1985a). Wilson (1969) reports that *Carex aquatilis* associations trap sediment from overbank flows which forms a clay pan, eventually raising the water table. This process drives retrogressive succession, and a plant association dominated by *Carex utriculata* takes over on these sites (Wilson 1969).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Carex aquatilis</i> , <i>Carex utriculata</i> , <i>Juncus balticus</i>
Forb	<i>Rumex aquaticus</i> , <i>Mentha arvensis</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Carex aquatilis</i>
Forb	<i>Epilobium</i> spp., <i>Pedicularis groenlandica</i> , <i>Caltha leptosepala</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Carex aquatilis</i> , <i>Carex utriculata</i> , <i>Juncus balticus</i> , <i>Deschampsia caespitosa</i> , <i>Hordeum brachyantherum</i>
Forb	<i>Rumex aquaticus</i> , <i>Mentha arvensis</i>

**Global**

**Stratum**

Graminoid

Forb

**Species**

*Carex aquatilis*

*Epilobium* spp.

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**SYNONYMY:**

- DRISCOLL FORMATION CODE: V.C.6.a. (Driscoll et al. 1984)
- *Carex aquatilis* (Bourgeron and Engelking 1994)
- *Carex aquatilis* Association (Kovalchik 1993) = (p.168)
- *Carex aquatilis* Association (Crowe and Clausnitzer 1997) = (p.174)

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G5.

**Global Classification Comments:** *Carex aquatilis* Herbaceous Vegetation (CEGL001802) is distinguished from *Carex aquatilis* – *Carex utriculata* Herbaceous Vegetation (CEGL001803) and *Carex aquatilis* - *Pedicularis groenlandica* Herbaceous Vegetation (CEGL001804) by the dominance of *Carex aquatilis*. If *Carex utriculata* is present, it is no more than 1/3 of the total cover.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Carex aquatilis* Herbaceous Vegetation is found on the first terrace adjacent to the Grape Creek channel and in its major tributary drainages, particularly Boulder Creek, within the monument. These drainages lie between approximately 8350-8650 feet elevation.

**Global Range:** This association is common and located throughout the western U.S. and Canada.

**Nations:** US

**States/Provinces:** AZ? CA CO ID MT NM NV OR UT WA WY

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 12, 25, 77

**Classification Confidence:** 1 **Identifier:** CEGL001802

**REFERENCES:** Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bierly 1972, Bourgeron and Engelking 1994, Briggs and MacMahon 1983, Bunin 1975c, Cox 1933, Crowe and Clausnitzer 1997, Driscoll et al. 1984, Giese 1975, Hall 1971, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Johnson 1932a, Johnson 1932b, Johnson 1936, Johnson 1939, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1995, Kittel et al. 1996, Komarkova 1976, Kovalchik 1993, Kovalchik and Elmore 1992, Lewis 1970, Manning and Padgett 1995, Mattson 1984, Norton et al. 1981, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1920, Robbins 1918, Sanderson and Kettler 1996, Terwilliger et al. 1979a, Tuhy 1981, Tuhy and Jensen 1982, Wilson 1969, Youngblood et al. 1985a, Youngblood et al. 1985b

**V.A.5.N.k.56. CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Nebraska Sedge Seasonally Flooded Herbaceous Alliance

**CAREX NEBRASCENSIS HERBACEOUS VEGETATION**

Nebraska Sedge Herbaceous Vegetation

**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** These minor wetlands occur on the western Great Plains and throughout much of the western U.S. Elevation ranges from 1000-2800 m (3300-9200 feet). Stands form open meadows that occur along the margins of streambanks, flat floodplains, and lakes often forming a band along the alluvial terrace, or on marshy areas surrounding springs and below seeps on

lower hillslopes. This association is often found on well-developed soil, but occurs on a wide variety of soil types that tend to be fine-textured alluvium, or clay to organic and are typically gleyed and mottled near the surface because of the high water table most of the growing season. The vegetation is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex nebrascensis*. Other graminoid species may be present such as *Carex praegracilis*, *Calamagrostis stricta*, *Deschampsia caespitosa*, *Eleocharis palustris*, *Glyceria striata*, *Juncus balticus*, *Schoenoplectus pungens* (= *Scirpus pungens*), or *Triglochin maritima*. Forb cover is generally low, but can be high in moist locations.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS Wetland System: PALUSTRINE

**Florissant Fossil Beds NM Environment:** This herbaceous vegetation forms nearly pure, small stands only in the northeastern corner of the monument. The stands are interspersed with clumps of *Salix monticola* and may be more appropriately described as a variation of that vegetation type for the monument.

**Global Environment:** This wetland plant association occurs on the western Great Plains and throughout much of the western U.S. Elevation ranges from 1000-2800 m (3300-9200 feet). Stands form open meadows that occur along the margins of streambanks, flat floodplains, and lakes often forming a band along the alluvial terrace. Stands have also been sampled from marshy areas surrounding springs and below seeps on lower hillslopes. This association is often found on well-developed soil, but occurs on a wide variety of soil types ranging from saturated organics to Mollisols to Entisols. Soils tend to be fine-textured alluvium, ranging from sandy, silty loam, clay loam, or clay to organic and are typically gleyed and mottled near the surface because of the high water table most of the growing season.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This herbaceous vegetation is characterized by tall *Carex nebrascensis* (from 0.5–1.0 m in height) growing in flowing water from 3–12 cm deep. The stands or patches are small, less than 200 m<sup>2</sup>, and very dense, with approximately 105% vegetation cover including the overstory shrub cover. The small stands occupied the entire, open drainage bottom and also grew under *Salix monticola* and *Salix brachycarpa* shrubs (approximately 20% vegetative cover). The most abundant associated herbaceous species were *Calamagrostis canadensis* (approximately 4% vegetative cover), *Heracleum maximum*, *Mentha arvensis*, and the exotic forb *Cirsium arvense* (approximately 5% vegetative cover in the aggregate). The ground cover was in excess of 90% for litter, and the remainder was flowing water exposed in a narrow channel, approximately 1 m wide. The sampled stand has become established adjacent to the foot of a steep cutbank, approximately 3 m in height.

This type is rare within the monument and has an aerial photo signature that is nearly black on true color aerial photography in the narrow drainage occupied. This sedge is perhaps better described within the variation of *Salix monticola* / Mesic Graminoids Shrubland (CEGL002659).

**Global Vegetation:** These wetlands are characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex nebrascensis* (25-99% cover), that generally forms small- to medium-sized meadows. Stands often are nearly pure *Carex nebrascensis*, but a variety of other graminoid species may be present such as *Carex praegracilis*, *Calamagrostis stricta*, *Calamagrostis canadensis*, *Deschampsia caespitosa*, *Eleocharis palustris*, *Glyceria striata*, *Juncus balticus*, *Schoenoplectus pungens* (= *Scirpus pungens*), or *Triglochin maritima*. Forb cover is generally low, but can be high in moist locations. Common forbs include *Eurybia integrifolia* (= *Aster integrifolius*), *Geum macrophyllum*, *Mentha arvensis*, *Mimulus glabratus*, *Heracleum maximum*, and *Ranunculus cymbalaria*. Introduced species *Poa pratensis*, *Poa palustris*, *Cirsium arvense*, and *Melilotus officinalis* may also be common.

In Nebraska, common species include *Agrostis stolonifera*, *Carex hystricina*, *Carex pellita* (= *Carex lanuginosa*), *Eleocharis erythropoda*, *Equisetum* spp., *Juncus balticus*, *Schoenoplectus pungens* (= *Scirpus pungens*), and *Triglochin* spp. (Steinauer and Rolfmeier 2000).

**Global Dynamics:** In Montana, the *Carex nebrascensis* Community Type is considered a grazing-disclimax. Under season-long grazing, *Carex nebrascensis* increases in abundance, replacing former dominant species (Hansen et al. 1995). However, under extreme grazing conditions and a resulting drop in the water table, *Juncus balticus* or *Poa pratensis* can eventually replace *Carex nebrascensis*. In Nevada, sites dominated by *Carex nebrascensis* are considered the Potential Natural Community (Manning and Padgett 1995), which appears to be the case in undisturbed stands in Colorado.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

###### Stratum

Graminoid

###### Species

*Carex nebrascensis*, *Calamagrostis canadensis*

**Global**

**Stratum**

Graminoid

**Species**

*Carex nebrascensis*

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Graminoid

**Species**

*Carex nebrascensis*, *Calamagrostis Canadensis*

**Global**

**Stratum**

Graminoid

**Species**

*Carex nebrascensis*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**SYNONYMY:**

- DRISCOLL FORMATION CODE:V.C.6.a. (Driscoll et al. 1984) B
- *Carex nebrascensis* (Bourgeron and Engelking 1994) =
- *Carex nebrascensis-Catabrosa aquatica-Juncus arcticus ssp. ater* Spring Wetland (Baker 1982b) =
- *Carex nebrascensis* Association (Cooper and Cottrell 1990) =
- Wet Meadow (Hall 1973) B
- *Carex nebrascensis* Community Type (Hall and Hansen 1997)
- *Carex nebrascensis* Community Type (Hansen et al. 1995)
- Nebraska Sedge (*Carex nebrascensis*) Community (Jones and Walford 1995) =
- *Carex nebrascensis* Herbaceous Vegetation (Kittel et al. 1994)
- *Carex nebrascensis* Herbaceous Vegetation (Kittel et al. 1996)
- *Carex nebrascensis* Herbaceous Vegetation (Kittel et al. 1999) =
- Nebraska Sedge Community Type (Kovalchik 1987) =
- *Carex nebrascensis* Community Type (Manning and Padgett 1995) =
- *Carex nebrascensis* Herbaceous Vegetation (Marriott and Faber-Langendoen 2000) =
- *Carex nebrascensis* Community Type (Padgett et al. 1988b)
- *Carex nebrascensis* Community Type (Padgett et al. 1989) =
- *Carex nebrascensis* Community Type (Youngblood et al. 1985a) =
- *Carex nebrascensis* Community Type (Youngblood et al. 1985b)

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G4.

**Global Classification Comments:** In the Black Hills, classification of stands was problematic due to identification problems with *Carex nebrascensis* and *Carex aquatilis*. The two are difficult to distinguish based on available keys and written descriptions (Marriott and Faber-Langendoen 2000).

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Carex nebrascensis* Herbaceous Vegetation is best represented along the trail that leads to the northeastern corner of the monument. The purest stand occurs at the foot bridge crossing of the unnamed creek.

**Global Range:** This sedge meadow type is widely distributed from the western Great Plains into the western mountains of the United States, ranging from South Dakota and Montana to possibly as far west as Washington, south to California and east to New Mexico.

**Nations:** US

**States/Provinces:** AZ CA CO ID MT NE NM? NV OR SD UT WA? WY

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Present as very small stands.

**Classification Confidence:** 1 **Identifier:** CEG001813

**REFERENCES:** Baker 1982b, Bourgeron and Engelking 1994, Cooper and Cottrell 1990, Driscoll et al. 1984, Hall 1973, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Jones 1992b, Jones and Walford 1995, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999, Kovalchik 1987, Manning and Padgett 1995, Marriott and Faber-Langendoen 2000, Mutz and Queiroz 1983, Padgett et al. 1988b, Padgett et al. 1989, Steinauer and Rolfsmeier 2000, Youngblood et al. 1985a, Youngblood et al. 1985b

### V.A.5.N.k.13. JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE

#### Baltic Rush Seasonally Flooded Herbaceous Alliance

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#### JUNCUS BALTICUS HERBACEOUS VEGETATION

##### Baltic Rush Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** The Baltic rush wet meadow community is found widely throughout the western United States. This wet meadow vegetation occurs as small, dense patches on flat stream benches, along overflow channels, and near springs. Soils are usually sandy clay loam or fine sands and mottled or gleyed. Stands are characterized by a dense sward of *Juncus balticus* and often minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis*, or *Carex utriculata*. Other common species include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. The introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera* codominate some stands. Forb cover is generally low and includes wetland species like *Caltha leptosepala*, *Rumex aquaticus* and *Dodecatheon pulchellum*. *Iris missouriensis* can be common in heavily grazed stands. Shrubs are not common. This association is often considered to be a grazing-induced community since it increases with disturbance.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** *Juncus balticus* is a rhizomatous, perennial graminoid that forms extensive stands on the upper (usually second) floodplain terrace. Species of sedge dominate saturated soils of the first terrace, which is usually inundated adjacent to the flowing water. On the second terraces, groundwater is from 30 cm to 1.5 m below the ground surface, except during spring snowmelt and runoff, when it is nearer the surface. This herbaceous vegetation is persistent, often occupying floodplain terraces, even after streams have incised and the groundwater table has dropped significantly as evidenced by prairie dog colonies forming in Baltic rush terrace stands west of the Hornbek Homestead. At this site, Grape Creek has incised approximately 4–5 m deep.

**Global Environment:** This widespread herbaceous wetland community is found throughout western North America. Elevation ranges from 1420–3500 m. Stands usually occur as small, dense patches on flat to gently sloping sites near seeps and streams. Stream channels are highly variable in size and type ranging from narrow to moderately wide, and deeply entrenched to very sinuous (Kittel et al. 1999). Soils are also variable and range from alluvial sandy and well-drained, to poorly drained silty clay loam, to organic; however, soils tend to be finer-textured, alkaline and may be saline (Brotherson and Barnes, Kittel et al. 1999, Padgett et al. 1989). Cobbles and gravel are common on many sites, and gleyed and mottled horizons are often present because of flooding or high water tables (Kittel et al. 1999).

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Juncus balticus* is a medium-tall graminoid (0.5–1.0 m in height) that forms nearly monotypic stands on second terraces of stream floodplains within the monument. It is a component of several other moist soil plant associations dominated by sedge, forb and grass species. When the soil is moist to saturated, low hummocks are present within a stand. The stands are dense, with the graminoid component providing foliar cover of from 65–90%. The ground cover was typically 100% litter, to 10 cm deep. Commonly associated graminoids included *Deschampsia caespitosa*, the exotic *Poa pratensis*, *Iris missouriensis*, and *Hordeum brachyantherum*. Several forbs, including *Rumex aquaticus*, *Cirsium scariosum* (= *Cirsium tioganum*), *Achillea millefolium*, *Potentilla plattensis*, *Polygonum bistortoides*, and the exotic *Cirsium arvense*, are present but rarely contribute more than 2–5% to the foliar cover. The habitat is usually riddled with small mammal burrows within the thick litter layer.

*Juncus balticus* Herbaceous Vegetation has a dark green to black signature on true color aerial photography. This signature is dull to bright red for CIR aerial photos. Drier sites are becoming invaded by *Cirsium arvense* and *Linaria vulgaris* at some locations.

**Global Vegetation:** This association is characterized by a low (<50 cm), dense graminoid layer dominated by the rhizomatous perennial *Juncus balticus*. Minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis* or *Carex utriculata*, is often present. Other common graminoids include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. Forb cover is generally low but may include *Caltha leptosepala*, *Glaux maritima*, *Maianthemum stellatum*, *Rumex aquaticus*, *Cirsium scariosum* (= *Cirsium tioganum*), *Achillea millefolium*, *Potentilla plattensis*, *Polygonum bistortoides*, *Dodecatheon pulchellum*, and *Iris missouriensis*. Shrubs are not common, but occasional *Salix* spp. may occur. Some stands may be codominated by the introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera*. Other introduced species, such as *Taraxacum officinale*, *Trifolium* spp., *Cirsium arvense*, *Lactuca serriola*, *Phleum pratense*, and *Thinopyrum intermedium*, may occur in disturbed stands.

**Global Dynamics:** This association is considered by some to be a grazing-induced community because *Juncus balticus* is tolerant of grazing (low palatability when mature) and increases with grazing disturbance (Hansen et al. 1995, Padgett et al. 1989). Nearly pure stands of *Juncus balticus* may indicate that the site was heavily grazed in the past (Hansen et al. 1995). However, this association also occurs as a stable, late-seral community in areas with low disturbance (Kittel and Lederer 1993).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Juncus balticus</i> , <i>Deschampsia caespitosa</i> , <i>Poa pratensis</i>
Forb	<i>Rumex aquaticus</i> , <i>Cirsium scariosum</i> , <i>Achillea millefolium</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Juncus balticus</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Juncus balticus</i> , <i>Deschampsia caespitosa</i>
Forb	<i>Rumex aquaticus</i> , <i>Cirsium scariosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Juncus balticus</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

- *Eleocharis palustris* - *Juncus balticus* Herbaceous Vegetation (CEGL001835)
- *Juncus balticus* - *Carex rossii* Herbaceous Vegetation (CEGL001839)

#### SYNONYMY:

- DRISCOLL FORMATION CODE: V.C.6.a. (Driscoll et al. 1984)
- *Juncus balticus* (Bourgeron and Engelking 1994)
- *Juncus balticus* Wetland Plant Association (Baker 1984a) =
- Saline Meadow (Brotherson and Barnes 1984) =
- *Juncus balticus* Community Type (Hansen et al. 1995) =
- *Juncus balticus* Community Type (Hall and Hansen 1997) =
- Baltic Rush (*Juncus balticus*) Dominance Type (Jones and Walford 1995) =
- *Juncus arcticus*/*Carex* spp. Plant Association (Johnston 1987) =
- *Juncus balticus* Herbaceous Vegetation Association (Kittel et al. 1999) =
- Baltic Rush Alliance (Muldavin et al. 2000a) B. includes 5 similar *Juncus balticus* community types.
- *Juncus balticus* Vegetation Type (Mutz and Graham 1982) =
- *Juncus balticus*/*Carex* spp. Habitat Subtype (Olson and Gerhart 1982) =

- *Juncus balticus* Community Type (Padgett et al. 1989) =
- *Juncus balticus* dominated (Zone 3) (Shupe et al. 1986) =. Zone 3 is the outer zone of the Great Basin playa.
- *Juncus balticus* Community Type (Tuhy and Jensen 1982)
- *Juncus balticus*/Carex spp. Habitat Type (Wasser and Hess 1982)
- *Juncus balticus* Community Type (Youngblood et al. 1985a) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G5.

**Global Classification Comments:** This association is often considered to be a grazing-induced community since it increases with grazing disturbance.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Juncus balticus* Herbaceous Vegetation occupies floodplain terraces of nearly every flowing stream (Grape and Boulder creeks and tributaries) and are also present in the bottoms of moist drainages and swales. This limits the type to the lowest elevations of the monument.

**Global Range:** This Baltic rush wet meadow community is found widely throughout the western United States, ranging from South Dakota and Montana west to Washington, south to possibly California, and east to New Mexico.

**Nations:** US

**States/Provinces:** CA? CO ID MT NM NV OR SD UT WA WY

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 9, 13, 38, 40, 94

**Classification Confidence:** 1 **Identifier:** CEG001838

**REFERENCES:** Baker 1984a, Bourgeron and Engelking 1994, Brotherson and Barnes 1984, Bunin 1985, Driscoll et al. 1984, Faber-Langendoen 2001, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Johnston 1987, Jones and Walford 1995, Kartesz 1994, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999, Komarkova 1986, Manning 1988, Muldavin et al. 2000a, Mutel 1973, Mutz and Graham 1982, Olson and Gerhart 1982, Padgett 1982, Padgett et al. 1989, Rector 1979, Richard et al. 1996, Shupe et al. 1986, Stewart 1940, Thompson 2001, Tuhy and Jensen 1982, Von Loh 2000, Wasser and Hess 1982, Youngblood et al. 1985a

### V.A.5.N.k.20. PHALARIS ARUNDINACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE

Reed Canary Grass Seasonally Flooded Herbaceous Alliance

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#### PHALARIS ARUNDINACEA WESTERN HERBACEOUS VEGETATION

Reed Canary Grass Western Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, and is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora. Elevations range from near sea level to 1700 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Soils are commonly fine-textured and may be flooded for brief to extended periods. The vegetation is characterized by a dense, tall herbaceous layer (often >80% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in mono-cultures. Associated species may include *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus* (= *Scirpus acutus*), and many other species in trace amounts where disturbed. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, and *Phleum pratense* are common in some stands.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** PALUSTRINE

**Florissant Fossil Beds NM Environment:** This herbaceous vegetation is an exotic mesic grassland restricted to drainages with flowing water and/or high groundwater tables. *Phalaris arundinacea* was apparently introduced historically to revegetate a disturbed

water pipeline corridor and subsequently invaded adjacent riparian and wetland sites. Reed canarygrass may also have been introduced historically to provide streambank protection and/or to enhance forage production for livestock on these once, private ranch lands.

**Global Environment:** This association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, and is likely more widespread in the western United States. Elevations range from near sea level to 1700 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Sites are flat to rolling. Soils are commonly fine-textured, but can be coarser in texture. Subsoil is often mottled and gleyed (Crawford 2001). Sites are generally flooded during the growing season, but flooding can vary from brief to extended periods.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This mesic grassland is characterized by almost pure stands of *Phalaris arundinacea* from 1.0-1.5 m in height and in excess of 75% foliar cover. The litter layer is extremely dense, to 10 cm thick, and is riddled by small mammal tunnels. There are generally only a few native species associated with this type, occupying the drier margins of the stand, including *Juncus balticus* and *Cirsium scariosum* (= *Cirsium tioganum*). Other exotic forbs such as *Cirsium arvense* and graminoids such as *Poa pratensis*, *Hordeum brachyantherum*, and *Bromus inermis* were observed along the stand margins and in adjacent, drier habitats. Only a few large stands or patches of this association were present in Boulder and Grape creeks, and small patches occurred along drainages and on moist sites within the floodplain of these and other creeks.

These stands are apparently stable once established, showing no signs of invasion by surrounding native and/or other exotic species. Should the type be restored to non-invasive species, it would likely support stands of *Juncus balticus*, *Carex utriculata*, and *Carex aquatilis*.

**Global Vegetation:** This association is characterized by a dense, tall herbaceous layer (often >90% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species such as *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus* (= *Scirpus acutus*), *Polygonum amphibium*, *Solidago canadensis*, *Urtica dioica*, and many other species may be present in trace amounts especially where disturbed. Occasional *Populus tremuloides*, *Salix exigua*, *Rubus idaeus*, or *Symphoricarpos albus* may be present in some stands. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, *Poa pratensis*, and *Phleum pratense* are common in some disturbed stands.

**Global Dynamics:** *Phalaris arundinacea* produces abundant herbage and is planted for livestock forage. It is tolerant of moderate grazing by livestock, although heavy grazing will reduce density (Hansen et al. 1995). *Phalaris arundinacea* is a threat to riparian and wetland areas because it spreads rapidly from rhizomes, dominating the sites, and is extremely difficult to remove once established (Hansen et al. 1995). Fire has been used with limited success to control the spread of *Phalaris arundinacea*, but the high water table where it grows makes it difficult to burn during the growing season (Hansen et al. 1995).

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i>

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i> , <i>Juncus balticus</i>
Forb	<i>Cirsium scariosum</i>

##### Global

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i>

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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**GLOBAL SIMILAR ASSOCIATIONS:**

- *Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174)
- *Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044)

**SYNONYMY:**

- DRISCOLL FORMATION CODE: V.A.4.a. (Driscoll et al. 1984)
- *Phalaris arundinacea* (Bourgeron and Engelking 1994)
- *Phalaris arundinacea* Habitat Type (Hansen et al. 1995)
- *Phalaris arundinacea* Habitat Type (Hall and Hansen 1997)
- *Phalaris arundinacea* Association (Crawford 2001)
- *Phalaris arundinacea* Monotype (Muldavin et al. 2000a)

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** G5.

**Global Classification Comments:** Other natural associations included in this alliance are found throughout the northeastern United States, but this western association's distribution as a natural type is not clear because of extensive planting as a forage crop (Hansen et al. 1995, Hall and Hansen 1997). Further work is required to resolve the natural versus introduced nature of this type in western North America.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Phalaris arundinacea* Western Herbaceous Vegetation is best represented in linear stands occupying Boulder and Grape creeks. These creeks are controlled by a series of dams constructed for historic livestock watering ponds.

**Global Range:** This association is reported from throughout Washington, Colorado, Nebraska, Montana and Idaho and into northeastern Utah and is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in many wetlands and riparian areas.

**Nations:** US

**States/Provinces:** CO ID MT NE NM UT WA

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 8, 46

**Classification Confidence:** 1 **Identifier:** CEGL001474

**REFERENCES:** Bourgeron and Engelking 1994, Cooper et al. 1995, Crawford 2001, Driscoll et al. 1984, Hall and Hansen 1997, Hansen et al. 1995, Kittel et al. 1999, Muldavin et al. 2000a, Von Loh 2000

**V.A.7.N.e. Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer**

**V.A.7.N.e.4. CHRYSOTHAMNUS VISCIDIFLORUS SHRUB HERBACEOUS ALLIANCE**

Green Rabbitbrush Shrub Herbaceous Alliance

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**CHRYSOTHAMNUS VISCIDIFLORUS – ERICAMERIA PARRYI SHRUB HERBACEOUS VEGETATION [PROVISIONAL]**

Green Rabbitbrush – Parry Rabbitbrush Shrub Herbaceous Vegetation

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** Not applicable.

**ENVIRONMENTAL DESCRIPTION**

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This shrub herbaceous vegetation occupies decomposing Pikes Peak granite gravels with fine silt and clay soil particles interspersed. Stand exposure ranged from northeast to southeast (60°-165°), and the slopes are moderately steep, from 5–11%. The sites are considered well-drained to rapidly drained. On similar sites elsewhere in the monument, this location would support an Arizona Fescue – Slimstem Muhly Grassland. Green Rabbitbrush – Parry Rabbitbrush Shrub

Herbaceous Vegetation may become established because of a combination of disturbance by mammals historically and the dry soils of these exposures.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Stands are less than 0.5 m tall and provide from 25–55% foliar cover for all species. The dominant dwarf-shrubs, e.g., *Chrysothamnus viscidiflorus* and *Ericameria parryi*, *Artemisia frigida*, and *Gutierrezia sarothrae*, typically provide from 20–35% foliar cover. Grass species common to dwarf rabbitbrush stands include *Bouteloua gracilis*, *Muhlenbergia filiculmis*, *Festuca arizonica*, *Elymus elymoides*, and *Koeleria macrantha*, and they provide from 15–25% foliar cover. Foliar cover by forbs was less than 5% for all stands sampled and typically was in the range of 2–4%. The more common forbs observed included *Hymenoxys richardsonii*, *Geranium caespitosum*, and *Besseyia plantaginea*. Ground cover in the form of bare soil and small gravel derived from Pikes Peak granite typically averaged from approximately 60–70%. The remainder of ground cover for each stand was litter, covering from 30–40% of the unvegetated surface. Some burrowing activity by prairie dogs, other ground squirrels, and pocket gophers was observed on nearly every stand sampled, and it is possible that this plant association requires such disturbance/foraging activity to persist.

This association has a distinct dark gray aerial photo signature when viewing true color photography, and a dull pink photo signature on CIR.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Chrysothamnus viscidiflorus</i> , <i>Ericameria parryi</i> , <i>Artemisia frigida</i> , <i>Gutierrezia sarothrae</i>
Graminoid	<i>Bouteloua gracilis</i> , <i>Muhlenbergia filiculmis</i> , <i>Festuca arizonica</i>
Forb	<i>Hymenoxys richardsonii</i> , <i>Besseyia plantaginea</i>

##### Global Stratum

##### Species

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Chrysothamnus viscidiflorus</i> , <i>Ericameria parryi</i> , <i>Artemisia frigida</i> , <i>Gutierrezia sarothrae</i>
Graminoid	<i>Bouteloua gracilis</i> , <i>Muhlenbergia filiculmis</i>
Forb	<i>Besseyia plantaginea</i>

##### Global Stratum

##### Species

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** Not applicable.

**Global Classification Comments:** Not applicable.

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Chrysothamnus viscidiflorus* - *Ericameria parryi* Shrub Herbaceous Vegetation is present on the slopes of low hills and ridges at the lower elevations (approximately 8325–8450 feet) within the monument.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:**

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 34, 36, 37, 98

**Classification Confidence:** Identifier: To be determined.

**REFERENCES:**

## V.A.7.N.h. Medium-tall temperate grassland with a sparse xeromorphic (often thorny) shrub layer

### V.A.7.N.h.2. YUCCA GLAUCA SHRUB HERBACEOUS ALLIANCE

Soapweed Yucca Shrub Herbaceous Alliance

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#### YUCCA GLAUCA / MUHLENBERGIA MONTANA SHRUBLAND

Soapweed Yucca / Mountain Muhly Shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This shrubland is found on gravelly substrate on steep south- to southeast-facing slopes (130°–136° were recorded) of ridges and hills. This gravelly substrate resulting from the weathering of Pikes Peak granite bedrock also supported *Schizachyrium scoparium* grasslands, sparse stands of *Cercocarpus montanus* shrublands, sparse *Pinus ponderosa* woodlands, and relatively dense stands of *Muhlenbergia montana*.

**Global Environment:** Not applicable.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Yucca glauca* is the dominant dwarf-shrub of this association, but the stands are typically dominated by an herbaceous species, particularly *Muhlenbergia montana* and/or *Bouteloua gracilis*. *Yucca glauca* typically provides foliar cover of approximately 15%, although one stand on the northern boundary fenceline covered an estimated 40% of the ground surface. Individual *Yucca glauca* shrubs are small, less than 0.5 m in height, and have a small crown diameter but are usually quite dense when present as stands. *Yucca glauca* dwarf-shrubs are also minor components of other plant associations found on south-facing and steep slopes, including those dominated by *Cercocarpus montanus*, *Pinus ponderosa*, *Muhlenbergia montana*, *Bouteloua gracilis*, and *Schizachyrium scoparium*. Commonly associated species in stands include *Muhlenbergia montana* and *Bouteloua gracilis*, which provided more foliar cover (15%–40% in two stands sampled) than does *Yucca glauca*. Only *Grindelia subalpina* provided foliar cover over 1% for forbs present in this type. Ground cover ranged from 50–70% small gravel derived from eroding Pikes Peak granite boulders and 30–50% litter, to approximately one cm deep on these rapidly drained sites.

This type will probably be indistinguishable on aerial photography from *Festuca arizonica* and *Muhlenbergia montana* herbaceous types because the yucca shrubs are small and usually associated with grasses.

**Global Vegetation:** Not applicable.

**Global Dynamics:** Not applicable.

#### MOST ABUNDANT SPECIES

**Florissant Fossil Beds NM**

**Stratum**

Shrub

**Species**

*Cercocarpus montanus*

Dwarf-shrub	<i>Yucca glauca</i> , <i>Artemisia frigida</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Bouteloua gracilis</i>
Forb	<i>Grindelia subalpina</i>

**Global  
Stratum**

**Species**

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

**Species**

Dwarf-shrub	<i>Yucca glauca</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Bouteloua gracilis</i>
Forb	<i>Grindelia subalpina</i>

**Global  
Stratum**

**Species**

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global  
Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** Not applicable.

**Global Classification Comments:** Not applicable.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** *Yucca glauca* / *Muhlenbergia montana* Shrubland occupies south-facing, moderately steep to steep, rapidly drained slopes (16%–29%) on the larger hills and ridges within the monument. The elevation range for the type was recorded between 8400 feet and 8650 feet, and the stands occupied decomposing Pikes Peak granite gravels. Individual *Yucca glauca* shrubs may be found at higher elevations, but still on south-facing slopes.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** MT

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plots 92, 99

**Classification Confidence:** Identifier: To be determined.

**REFERENCES:**

**V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic rooted vegetation**

**V.C.2.N.a.7. LEMNA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE**

Duckweed species Permanently Flooded Herbaceous Alliance

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**LEMNA SPP. PERMANENTLY FLOODED HERBACEOUS VEGETATION**

Duckweed species Permanently Flooded Herbaceous Vegetation

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This aquatic association of floating vegetation is known to occur throughout North America. *Lemna* spp. are the sole or dominant plants floating on the water surface. *Lemna*-dominated aquatic vegetation occupies wetlands that are permanently flooded, semipermanently flooded to seasonally flooded. Water chemistry is fresh. The standing water habitat is relatively shallow, generally less than 2–4 m (6.6–13.1 feet) and occurs as ponds, lakes, ditches, stock ponds, and backwater sloughs of

river and stream channels. Standing water for much or most of the growing season is characteristic. Depth of the water is of no consequence to floating plants; they occur where the wind pushes them. *Potamogeton* spp., *Sagittaria* spp., or *Persicaria* spp. may also be present in Rocky Mountain ponds. While these later species are rooted submerged species, and technically not part of the strictly floating community, they do intermingle. Ponds in California may also include *Spirodela* spp., *Azolla* spp., and *Wolffiella* spp. Community composition may change hour to hour, yet the environment, only the top few centimeters of water, is homogeneous. Biomass can be abundant under eutrophic conditions.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: PALUSTRINE

**Florissant Fossil Beds NM Environment:** Historic livestock watering ponds are formed behind dams constructed of gravel; much of the gravel was mined from borrow areas on uplands above the drainages. Many of the dams are massive and oversized for the drainages they occupy, have overflow channels installed and a culvert to control water depth. A few are equipped with an outlet gate that could possibly be closed to fill the pond to a higher level than the invert. Along Grape Creek, west of Hornbek Homestead, beaver have constructed many dams and ponds on the creek. The deeper, standing water provides habitat for both rooted and floating aquatic vegetation, and the shallow water and saturated shoreline supports emergent wetland species. A few ponds become dry during the course of the summer season and may exist as barren flats, or may vegetate to a *Hordeum jubatum* herbaceous type.

**Global Environment:** *Lemna*-dominated aquatic vegetation occupies wetlands that are permanently flooded, semi-permanently flooded to seasonally flooded. Water chemistry is fresh. The standing water habitat is relatively shallow, generally less than 2-4 m (6.6-13.1 feet) and occurs as ponds, lakes, ditches, stock ponds, and backwater sloughs of river and stream channels. Standing water for much or most of the growing season is characteristic. Depth of the water is of no consequence to floating plants; they occur where the wind pushes them. Community composition may change hour to hour, yet the environment, only the top few centimeters of water, is homogeneous. Biomass can be abundant under eutrophic conditions.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Ponds supporting the floating aquatic *Lemna minor* are small, typically less than 200 m<sup>2</sup>. Depths for most ponds are estimated to be from 1–2 m in the deepest portion. The foliar cover value for *Lemna minor* may be as little as 5%, but more typically it falls in the 40–80% range. *Lemna minor* is present across the surface of many ponds, because of the wind protection provided by the dam, drainage sides, and the tall vegetation growing from the shallow water and saturated soils surrounding the pond. The shoreline vegetation consists of emergent wetland species, particularly *Carex utriculata*, *Eleocharis palustris*, *Glyceria grandis*, *Cirsium scariosum* (= *Cirsium tioganum*), *Mentha arvensis*, and the exotic species *Phalaris arundinacea* and *Cirsium arvense*. The shoreline emergent wetland stands are dense (approximately 90–100% foliar cover within the stand) and provide foliar cover of approximately 25% for the entire pond. Bottom substrates consist of gravel and muck. Litter for each pond typically approaches approximately 20–25% and is associated with the dense shoreline growth from shallow water, to 0.5 m deep.

All ponds within the monument are less than the minimum mapping unit (0.5 ha), however, they are easily identified on both true color and CIR photography, e.g., black for open water and pink to dark red for emergent wetland vegetation.

**Global Vegetation:** *Lemna* spp. are the sole or dominant plants floating on the water surface. *Potamogeton* spp., *Sagittaria* spp., or *Persicaria* spp. may also be present in the Rocky Mountains. While these later species are rooted submerged species, and technically not part of the strictly floating community, they do intermingle. Ponds in California may also include *Spirodela* spp., *Azolla* spp., and *Wolffiella* spp. (Windell et al. 1986).

**Global Dynamics:** Because the biomass of floating organisms is generally not great, they do not have an important influence on the accumulation of organic matter on the pond bottom. However, a study comparing Rocky Mountain with Illinois pond communities found that similar types in Illinois ponds have twice the number of species and biomass found in Colorado ponds (Fuller 1930).

## MOST ABUNDANT SPECIES

### Florissant Fossil Beds NM

#### Stratum

Forb  
Graminoid

#### Species

*Lemna minor*, *Myriophyllum sibiricum*, *Ranunculus trichophyllus*  
*Carex utriculata*, *Juncus balticus*, *Glyceria grandis*, *Eleocharis palustris*, *Beckmannia syzigachne*,  
*Phalaris arundinacea*

### Global

#### Stratum

Forb

#### Species

*Lemna minor*

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CHARACTERISTIC SPECIES

Florissant Fossil Beds NM

Stratum

Species

Forb

*Lemna minor*

Graminoid

*Carex utriculata*

Global

Stratum

Species

Forb

*Lemna minor*

OTHER NOTEWORTHY SPECIES

Florissant Fossil Beds NM

Global

Stratum

Species

GLOBAL SIMILAR ASSOCIATIONS:

SYNONYMY:

GLOBAL STATUS AND CLASSIFICATION COMMENTS

Global Conservation Status Rank: G3?.

Global Classification Comments: *Lemna* spp. and other characteristic wetland taxa that comprise floating, submerged and aquatic rooted associations are not well reported in the literature, but they are known to occur in the field.

ELEMENT DISTRIBUTION

Florissant Fossil Beds NM Range: *Lemna* spp. Permanently Flooded Herbaceous Vegetation occupies small livestock watering and some beaver-created ponds located on Grape and Boulder creeks and their tributary drainages. The ponds occur at the lowest elevations within the monument.

Global Range: *Lemna minor* is a cosmopolitan species (except South America), and only occurs as a community of floating vegetation. Therefore it is a widespread association, known to occur, if not documented as a community, throughout the United States, Canada, and in suitable habitats worldwide.

Nations: US

States/Provinces: CA CO IL

ELEMENT SOURCES

Florissant Fossil Beds NM Inventory Notes: Plots 2, 53

Classification Confidence: 2 Identifier: CEG003059

REFERENCES: Fuller 1930, Sawyer and Keeler-Wolf 1995, Windell et al. 1986

V.C.2.N.a.21. MYRIOPHYLLUM SIBIRICUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE

Siberian Water-milfoil Permanently Flooded Herbaceous Alliance

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MYRIOPHYLLUM SIBIRICUM HERBACEOUS VEGETATION

Siberian Water-milfoil Herbaceous Vegetation

ELEMENT CONCEPT

GLOBAL SUMMARY: This association has been described only from Colorado mountain lakes and ponds at roughly 2539 m (8300 feet) elevation. This association occurs in small ponds supporting submerged aquatic vegetation, typically less than 200 m<sup>2</sup>. Depths for most ponds are estimated to be from 1–2 m in the deepest portion. The total cover value for *Myriophyllum sibiricum* may be as little as 5%, but more typically it falls in the 40–80% range. Water can be quite saline and the plants heavily encrusted with lime salts. Ponds typically have concentric rings, or zones of vegetation, *Myriophyllum sibiricum* occupying the deepest portion of relatively shallow ponds. Concentric zones include bands of *Schoenoplectus tabernaemontani* (= *Scirpus validus*), *Carex* spp., and *Salix* spp.

## ENVIRONMENTAL DESCRIPTION

### USFWS Wetland System: PALUSTRINE

**Florissant Fossil Beds NM Environment:** Historic livestock watering ponds are formed behind dams constructed of gravel, much of the gravel was mined from borrow areas on uplands above the drainages. Many of the dams are massive and oversized for the drainages they occupy, have overflow channels installed and a culvert to control water depth. A few are equipped with an outlet gate that could possibly be closed to fill the pond to a higher level than the invert. Along Grape Creek, west of Hornbek Homestead, beaver have constructed many dams and ponds on the creek. The deeper, standing water provides habitat for both rooted and floating aquatic vegetation, and the shallow water and saturated shoreline supports emergent wetland species. A few ponds become dry during the course of the summer season and may exist as barren flats, or may vegetate to a *Hordeum jubatum* herbaceous vegetation type.

**Global Environment:** Ponds supporting *Myriophyllum sibiricum* tend to be smaller and shallower (maximum depth of 2 m), than lakes supporting *Stuckenia filiformis* (= *Potamogeton filiformis*), for example. Generally these are small ponds supporting submerged aquatic vegetation, typically less than 200 m<sup>2</sup>. Depths for most ponds are estimated to be from 1–2 m in the deepest portion. Hence it is most typically found in stock ponds and shallow ends of deeper, stagnant pools.

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Ponds supporting the submerged aquatic *Myriophyllum sibiricum* are small, typically less than 200 m<sup>2</sup>. Depths for most ponds are estimated to be from 1–2 m in the deepest portion. The foliar cover value for *Myriophyllum sibiricum* may be as little as 5%, but more typically it falls in the 40–80% range. The shoreline vegetation consists of emergent wetland species, particularly *Carex utriculata*, *Eleocharis palustris*, *Glyceria grandis*, *Cirsium scariosum* (= *Cirsium tioganum*), *Mentha arvensis*, and the exotics *Phalaris arundinacea* and *Cirsium arvense*. The shoreline emergent wetland stands are dense (approximately 90–100% foliar cover within the stand) and provide foliar cover of approximately 25% for the entire pond. Bottom substrates consist of gravel and muck. Litter for each pond typically approaches approximately 20–25% and is associated with the dense shoreline growth from shallow water, to 0.5 m deep.

All ponds within the monument are less than the minimum mapping unit, however, they are easily identified on both true color and CIR photography, e.g., black for open water and pink to dark red for emergent wetland vegetation.

**Global Vegetation:** The foliar cover value for *Myriophyllum sibiricum* may be as little as 5%, but more typically it falls in the 40–80% range. The shoreline vegetation consists of emergent wetland species, particularly *Carex utriculata*, *Eleocharis palustris*, *Glyceria grandis*, *Cirsium scariosum* (= *Cirsium tioganum*), *Mentha arvensis*, occasionally *Schoenoplectus tabernaemontani* (= *Scirpus validus*), and the exotics *Phalaris arundinacea* and *Cirsium arvense*. The shoreline emergent wetland stands are dense (approximately 90–100% cover within the stand) and provide cover of approximately 25% for the entire pond. Bottom substrates consist of gravel and muck. Litter for each pond typically approaches approximately 20–25% and is associated with the dense shoreline growth from shallow water to 0.5 m deep.

**Global Dynamics:** The growth of submersed vegetation, as time goes by, has a marked effect upon the habitat of shallow ponds. Material is washed into the lake, is deposited around the plants and gradually slows down the water currents. When the submersed and half-submersed plants die organic matter is formed and the lake bottom humus layer becomes greater. Plant remains build up on the bottom and cause a shallowing of the water. This changes the water depth, water temperatures and amount of light penetration to the lake bottom. Conditions change and become favorable for other species to colonize (Johnson 1936).

## MOST ABUNDANT SPECIES

### Florissant Fossil Beds NM

#### Stratum

Forb  
Graminoid

#### Species

*Myriophyllum sibiricum*, *Ranunculus trichophyllus*, *Lemna minor*  
*Carex utriculata*, *Juncus balticus*, *Glyceria grandis*, *Eleocharis palustris*, *Beckmannia syzigachne*,  
*Phalaris arundinacea*

### Global

#### Stratum

Forb

#### Species

*Myriophyllum sibiricum*

#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

###### Stratum

Forb  
Graminoid

###### Species

*Myriophyllum sibiricum*, *Ranunculus trichophyllus*, *Lemna minor*  
*Carex utriculata*

##### Global

###### Stratum

Forb

###### Species

*Myriophyllum sibiricum*

#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

##### Global

###### Stratum

###### Species

#### GLOBAL SIMILAR ASSOCIATIONS:

##### SYNONYMY:

- DRISCOLL FORMATION CODE:V.E.1.b. (Driscoll et al. 1984) B
- *Myriophyllum exalbescens* (Bourgeron and Engelking 1994) =

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** GUQ.

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Myriophyllum sibiricum* Herbaceous Vegetation occupies small livestock watering and some beaver-created ponds located on Grape and Boulder creeks and their tributary drainages. The ponds occur at the lowest elevations within the monument.

**Global Range:** This association has been described only from Colorado mountain lakes and ponds over 2440 m (8000 feet) in elevation.

**Nations:** US

**States/Provinces:** CO WY?

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 48, 63

**Classification Confidence:** 3 **Identifier:** CEG002000

**REFERENCES:** Bourgeron and Engelking 1994, Driscoll et al. 1984, Johnson 1936, Johnson 1939, Johnson 1941

### X.X.X.X.X. Hierarchy Placement Undetermined: Park specials & provisional types

#### IV.B.2.N.? ARTEMISIA FRIGIDA DWARF SHRUBLAND ALLIANCE?

Fringed Sagewort Dwarf-shrubland Alliance

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##### ARTEMISIA FRIGIDA / BOUTELOUA GRACILIS DWARF-SHRUBLAND

Fringed Sagewort / Blue Grama Dwarf-shrubland [Park Special?]

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** Within the monument, this dwarf-shrubland is located on deeper soils that are typically deposited in drainages, swales (interfluvies), and along lower hillslopes. The soil must be of a consistency (silty-clay and clay) that will



support burrowing activity in terms of both depth and cohesiveness. This type is found at the lower and mid-elevations (8350–8650 feet) predominantly, within the monument. The slopes ranged from 2–7% and were considered moderately well-drained. *Artemisia frigida* is a common, but rarely dominant, component of all herbaceous, shrub, and woodland communities that occur on upland sites within the monument. Adjacent to the monument, this dwarf-shrubland occupies prairie dog towns but also heavily grazed pastures in the vicinity of livestock watering ponds.

**Global Environment:** Not applicable

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This dwarf-shrubland becomes established on sites disturbed by prairie dogs. *Artemisia frigida* is an increaser under livestock grazing regimes and is evidently unpalatable or less palatable to prairie dogs, as well. The age of the colony determines to what extent *Artemisia frigida* dominates the site, and the following description covers sites that have been used by prairie dogs for several years. Prairie dog colonies that are densely occupied typically have vegetative cover values less than 40%. The foliar cover for *Artemisia frigida* ranges from 20–40% and other dwarf-shrubs, i.e., *Ericameria parryi*, *Chrysothamnus viscidiflorus*, *Gutierrezia sarothrae*, *Rosa acicularis*, and a species of *Solidago*, contribute from 5–20% foliar cover on some sites. The most abundant graminoid is *Bouteloua gracilis*, which is an increaser under light to moderate grazing regimes. Blue grama contributes approximately 5–10% foliar cover on sites that are moderate to heavily-grazed. Other graminoids present on established prairie dog towns include *Schedonnardus paniculatus*, *Poa fendleriana*, and *Nassella viridula*. They rarely contribute greater than 5% foliar cover, unless it is a less densely populated colony, then the cover values increase for these species. Forbs generally contribute less than 5% to the foliar cover; those species commonly associated with these disturbed sites include *Argentina anserina*, *Melilotus officinalis*, *Antennaria* sp., and *Achillea millefolium*. Ground cover is typically 60–90% bare soil and small gravel, with the remainder in herbaceous litter.

Prairie dog colonies supporting fringed sagewort disturbed vegetation show a high level of reflectance and appear as white or light areas on aerial photography, with a pattern of stippling where the hole density is moderate to high. It is likely that most colonies fall below the project minimum mapping unit (0.5 ha) in size; however, some very large colonies occur immediately adjacent to the northern monument boundary and long the South Platte River drainage outside the monument.

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i>
Graminoid	<i>Bouteloua gracilis</i>
Forb	<i>Achillea millefolium</i> , <i>Antennaria</i> sp.

##### Global

<u>Stratum</u>	<u>Species</u>
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#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Dwarf-shrub	<i>Artemisia frigida</i> , <i>Chrysothamnus viscidiflorus</i>
Graminoid	<i>Bouteloua gracilis</i> , <i>Nassella viridula</i>
Forb	<i>Argentina anserine</i>

##### Global

<u>Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

##### Global

<u>Stratum</u>	<u>Species</u>
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GLOBAL SIMILAR ASSOCIATIONS:

GLOBAL STATUS AND CLASSIFICATION COMMENTS

Global Conservation Status Rank:

Global Classification Comments:

ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Artemisia frigida* – *Bouteloua gracilis* Dwarf-shrubland is the result of disturbance by prairie dogs, and it is distributed according to soils appropriate for burrowing activity. These soils are deeper and are located in stream valleys, drainages, swales, and gentle slopes within the monument. Dwarf-shrub density is typically related to the age (permanence) of the colony at a particular site. On private land adjacent to the southern monument boundary, an increase in this dwarf-shrubland resulted from livestock grazing pressure.

Global Range: Not applicable

Nations: US

States/Provinces: CO

ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 47, 79

**Classification Confidence:** 3 **Identifier:** To be determined.

REFERENCES:

III.B.2.N.?. JAMESIA AMERICANA ROCK OUTCROP SHRUBLAND ALLIANCE

Waxflower Rock Outcrop Shrubland Alliance

JAMESIA AMERICANA ROCK OUTCROP SHRUBLAND

Waxflower Rock Outcrop Shrubland

ELEMENT CONCEPT

GLOBAL SUMMARY: Not applicable

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

**Florissant Fossil Beds NM Environment:** This rock outcrop shrubland occupies nearly every outcrop, regardless of size. Many of these sites are small, but the best examples grow from very large cliff faces on the upper shoulders of large hills. The slopes are steep (30–60%) and a few appear vertical. The aspect is predominantly southerly, but a few western exposures occur (150°–270°). The exposures are large Pikes Peak granite boulders that have sometimes weathered and cracked. The common shrubs grow within the cracks on the rocks and around the base of the rocks where accumulations of small gravel and soil occur.

Global Environment: Not applicable

VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This shrubland is relatively sparse because of the large boulders that are strewn on the landscape or appear as outcropping bedrock. Often, the lichens covering these rocks provide large amounts of foliar cover, at times from 30–60%. Typically, the dominant shrubs are from 1–2 m in height and provide foliar cover from approximately 10–25% across the rock outcrops. *Jamesia americana*, *Rubus deliciosus*, and *Ribes cereum* shrubs are always present, and lesser amounts of *Prunus virginiana*, *Cercocarpus montanus*, and *Dasiphora fruticosa* are sometimes observed. Common graminoids associated with these dry exposures include *Muhlenbergia montana* and *Bouteloua gracilis*, which provide foliar cover from 5–10% on most outcrops. Because the rock outcrops shed water and direct runoff to small drainages and protected sites, it is not unusual to have some more mesic graminoid species present, including *Deschampsia caespitosa*, *Bromus inermis*, and *Poa pratensis*. A few moist, protected sites support ferns, e.g., *Woodsia* spp. and *Dryopteris filix-mas*. Forbs rarely contribute more than 1–2% foliar cover on the rock outcrop formations and a variety are present. Non-vegetative cover within rock outcrops is typically that of boulders, small rock, and bare soil,

which approach 55–95% ground cover values. *Jamesia americana* shrubs often grow at the base of some boulders and drape around the sides much like a curtain, resulting in only a minor foliar cover value for the shrub.

Rock outcrops are readily observable as light or white spots on the aerial photography, both true color and CIR, because of reflectance. Many of the outcrops are small, not much more than one to several boulders, and under the minimum mapping unit (0.5 ha).

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Jamesia americana</i> , <i>Rubus deliciosus</i> , <i>Ribes cereum</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Bouteloua gracilis</i>
Forb	<i>Argentina anserine</i>

<u>Global Stratum</u>	<u>Species</u>
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#### CHARACTERISTIC SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Jamesia americana</i> , <i>Rubus deliciosus</i> , <i>Ribes cereum</i> , <i>Prunus virginiana</i> , <i>Cercocarpus montanus</i>
Graminoid	<i>Muhlenbergia montana</i> , <i>Bouteloua gracilis</i> , <i>Festuca arizonica</i>
Forb	<i>Argentina anserina</i> , <i>Phacelia heterophylla</i>

<u>Global Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

##### Florissant Fossil Beds NM

<u>Stratum</u>	<u>Species</u>
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<u>Global Stratum</u>	<u>Species</u>
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#### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G?.

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** *Jamesia americana* Rock Outcrop Shrubland occupies Pikes Peak granite boulder fields exposed on south- and west-facing slopes of large hills. The most prominent of these occur on the hill north of the Hornbek Homestead and the hill east of the visitors center. The recorded elevation range for the type was approximately 8300-8750 feet on very steep, rapidly drained slopes (30–60%).

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plots 33, 43, 91

**Classification Confidence:** 3 **Identifier:** To be determined

#### REFERENCES:

## V.?.5.N.?. HORDEUM JUBATUM SEMI-NATURAL HERBACEOUS ALLIANCE

Foxtail Barley Semi-natural Herbaceous Vegetation Alliance

### HORDEUM JUBATUM SEMI-NATURAL HERBACEOUS VEGETATION

Foxtail Barley Semi-natural Herbaceous Vegetation

#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Palustrine

**Florissant Fossil Beds NM Environment:** This exotic grass forms a nearly pure stand only in a dried livestock pond on a Grape Creek tributary, south of Lower Twin Rock Road, in the southeastern portion of the monument. *Hordeum jubatum* otherwise persists as scattered individual plants along the margins of emergent wetlands.

**Global Environment:** Not applicable

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This sparse, exotic grassland occupied a dried livestock pond, where *Hordeum jubatum* and *Beckmannia syzigachne*, both less than 0.5 m tall, provided approximately 5% vegetative cover. Two species of *Chenopodium* (*leptophyllum*, *album*) account for approximately 10% vegetative cover, and *Amaranthus retroflexus*, *Taraxacum officinale*, *Polygonum lapathifolium* (= *Persicaria lapathifolia*), and *Glaux maritima* are also present and provide an additional 10% vegetative cover. The ground cover consisted of bare soil within the bottom of the pond, possibly sediments carried in from upland pastures and agricultural land.

This dry livestock pond represents the only stand of *Hordeum jubatum* observed within the monument; another dry pond just west of the Lower Twin Rock Road junction with Teller County 1 was unvegetated. The aerial photo signature was black, because the pond was holding water at the time of the overflight.

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

#### MOST ABUNDANT SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Hordeum jubatum</i>
Forb	<i>Chenopodium leptophyllum</i> , <i>Glaux maritima</i>

**Global**

<u>Stratum</u>	<u>Species</u>
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#### CHARACTERISTIC SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Hordeum jubatum</i> , <i>Beckmannia syzigachne</i>
Forb	<i>Chenopodium leptophyllum</i> , <i>Glaux maritima</i>

**Global**

<u>Stratum</u>	<u>Species</u>
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#### OTHER NOTEWORTHY SPECIES

**Florissant Fossil Beds NM**

**Global**

<u>Stratum</u>	<u>Species</u>
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GLOBAL SIMILAR ASSOCIATIONS:

GLOBAL STATUS AND CLASSIFICATION COMMENTS

Global Conservation Status Rank:

Global Classification Comments:

ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** Only one stand of *Hordeum jubatum* was observed growing in the bottom of a dried livestock pond, within a Grape Creek tributary south of Lower Twin Rock Road, in the southeastern portion of the monument.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** CO

ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 16.

**Classification Confidence:** 3 **Identifier:** Not determined.

REFERENCES:

**V.A.5.N.???. PASCOPYRUM SMITHII – NASSELLA VIRIDULA HERBACEOUS VEGETATION ALLIANCE [PROVISIONAL]**

Western Wheatgrass – Green Needlegrass Herbaceous Vegetation Alliance

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**PASCOPYRUM SMITHII – NASSELLA VIRIDULA HERBACEOUS VEGETATION [PROVISIONAL]**

Western Wheatgrass – Green Needlegrass Herbaceous Vegetation

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ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable

ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** The largest, nearly pure stand of this type occupies the deeper, silty clay soils of the Grape Creek floodplain, second terrace. Elsewhere, it is subdominant to introduced species such as *Bromus inermis*, *Poa pratensis*, and *Linaria vulgaris*, or it is intermixed with native species, including *Juncus balticus* and *Festuca arizonica*. These sites occur along upper floodplain terraces, in moist swales, and on toeslopes of hills and ridges where silty clay soils occur.

**Global Environment:** Not applicable

VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** This potentially introduced grassland of native species is characterized by mixed stands of *Pascopyrum smithii*, *Nassella viridula*, *Bouteloua gracilis*, and *Artemisia frigida*. Only a portion of the community along Grape Creek northwest of the Hornbek Homestead site consists of a nearly pure stand of *Pascopyrum smithii*, however, it is very short (less than 0.5 m tall), while the associated *Nassella viridula* is between 0.5–1.0 m tall. Vegetative cover was between 60-70%, and litter completely covered the ground surface in the floodplain terrace stand sampled. At other locations, the *Pascopyrum smithii* and *Nassella viridula* stands are very small and often interspersed with other species, including *Bromus inermis*, *Linaria vulgaris*, and *Juncus balticus*. This association occupies the deeper silty clay soils of swales and on floodplain terraces.

This association occurred naturally within Badlands National Park in South Dakota on silty clay soils of plains, small ridges, and south-facing slopes (Von Loh et al. 1999).

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

### MOST ABUNDANT SPECIES

#### Florissant Fossil Beds NM

##### Stratum

##### Species

Dwarf-shrub

*Artemisia frigida*

Graminoid

*Pascopyrum smithii*, *Nassella viridula*, *Bouteloua gracilis*, *Agropyron cristatum*

Forbs

*Linaria vulgaris*

#### Global

##### Stratum

##### Species

Graminoid

*Pascopyrum smithii*, *Nassella viridula*

### CHARACTERISTIC SPECIES

#### Florissant Fossil Beds NM

##### Stratum

##### Species

Graminoid

*Pascopyrum smithii*, *Nassella viridula*

Dwarf-shrub

*Artemisia frigida*

#### Global

##### Stratum

##### Species

### OTHER NOTEWORTHY SPECIES

#### Florissant Fossil Beds NM

#### Global

##### Stratum

##### Species

#### GLOBAL SIMILAR ASSOCIATIONS:

*Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation

### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** GW

**Global Classification Comments:**

### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** This association is best represented on the floodplain terrace (second terrace) of Grape Creek, northwest of the Hornbek Homestead site. This site contained the largest stand observed (approximately 0.1 ha); it was thought to be introduced within the monument (Edwards and Weber 1990). Smaller stands occur in swales and along upper wetland margins, but these are rarely pure stands, rather they are mixed with other native and introduced species.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** CO

### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** *Pascopyrum smithii* is reported to be planted at FLFO.

**Classification Confidence:** **Identifier:** Not determined

**REFERENCES:** Von Loh, J., D. Cogan, J. Butler, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota. USBR Technical Service Center, Technical Memorandum No. 8260-00-02. Denver, CO.

## V.B.2.N.a. CIRSIIUM ARVENSE / MIXED GRAMINOIDS HERBACEOUS VEGETATION [PROVISIONAL]

Canada Thistle / Mixed Graminoids Herbaceous Vegetation Alliance

### CIRSIIUM ARVENSE – WEEDY FORBS HERBACEOUS VEGETATION

Canada Thistle - Weedy Forbs Exotic Vegetation

#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This Canada thistle type is widely naturalized in the northern United States and Canada. Stands occur on a variety of open disturbed habitats, including pastures, ditches, bottomlands, and waste areas. The vegetation is dominated by medium-tall (0.5-1 m) forbs. The dominant forb is *Cirsium arvense*, a naturalized species from Eurasia. Other weedy species may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata* (= *Stipa comata*), as well as others.

Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Palustrine

**Florissant Fossil Beds NM Environment:** Patches of *Cirsium arvense* occur throughout the monument, occupying floodplain terraces, bottoms of moist swales, livestock watering pond margins, and depressions remaining from breached livestock watering ponds. Most stands invaded sites with human or natural disturbance, and are continually disturbed by pocket gopher activity in extant stands. The monument is making extensive efforts to control the spread and eliminate current stands of *Cirsium arvense* by mowing and applying herbicides, among other management activities.

**Global Environment:** Stands occur on a variety of open disturbed habitats, including ditches, bottomlands, waste areas, and similar sites.

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** Stands or patches of *Cirsium arvense* are dense and grow to 0.5–1.0 m tall. They occupy nearly flat slopes in mesic sites of all aspects. *Cirsium arvense* contributes from 55–80% vegetative cover within the type, which contains a high litter value of 95–100%. Most stands support from 75–100% total vegetative cover. On most sites pocket gopher activity was moderate to high, continually disturbing the soil within the patches. The most common native species found in the dense Canada thistle stands are *Juncus balticus* and *Achillea millefolium*, which typically contribute from 1–5% herbaceous cover. In one palustrine wetland stand, *Carex utriculata* contributed approximately 40% aerial cover and the stand was classified under *Carex utriculata* Herbaceous Vegetation. Typically associated exotic species include *Poa pratensis*, *Bromus inermis*, *Elymus repens* (= *Elytrigia repens*), *Thlaspi arvense*, and *Linaria vulgaris*. At least some of the stands of *Cirsium arvense* appear to occupy areas with historic intense livestock use, as is observed around watering tanks, salt blocks, and holding pens.

*Cirsium arvense* stands are being actively managed at Florissant Fossil Beds NM, by mowing and herbicide application. The aerial photo signature ranges from dark green to black on true color images.

**Global Vegetation:** The type is dominated by medium-tall (0.5–1.0 m) forbs. The dominant forb is *Cirsium arvense*, a naturalized species from Eurasia. Other exotic weedy species may also occur in the stands, but native species are generally less than 10% herbaceous cover.

#### Global Dynamics:

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

##### Stratum

Forb  
Graminoids

##### Species

*Cirsium arvense*, *Linaria vulgaris*  
*Juncus balticus*, *Poa pratensis*

**Global  
Stratum**

Forb

**Species**

*Cirsium arvense*

**CHARACTERISTIC SPECIES**

**Florissant Fossil Beds NM**

**Stratum**

Forb

Graminoid

**Species**

*Cirsium arvense*, *Achillea millefolium*

*Juncus balticus*, *Poa pratensis*

**Global**

**Stratum**

Forb

**Species**

*Cirsium arvense*

**OTHER NOTEWORTHY SPECIES**

**Florissant Fossil Beds NM**

**Global**

**Stratum**

**Species**

**GLOBAL SIMILAR ASSOCIATIONS:**

*Cirsium arvense* – Weedy Forb Great Plains Herbaceous Vegetation

**GLOBAL STATUS AND CLASSIFICATION COMMENTS**

**Global Conservation Status Rank:** GW

**Global Classification Comments:** The stands at Florissant most closely fit this association that has been described for the midwestern United States. At Florissant native and introduced graminoid species co-occur with the *Cirsium*, but these communities are very similar to those found throughout the Midwestern U. S. and into Colorado.

**ELEMENT DISTRIBUTION**

**Florissant Fossil Beds NM Range:** This type is generally distributed as patches and small stands along creeks and mesic swales throughout the monument, especially along Grape Creek. It usually occurs as small patches, <0.25 ha, on floodplain terraces, moist swale bottoms, and around old livestock watering ponds.

**Global Range:** This type is widely naturalized in the northern United States and Canada.

**Nations:** US

**States/Provinces:** ND, SD, CO

**ELEMENT SOURCES**

**Florissant Fossil Beds NM Inventory Notes:** Plot 68

**Classification Confidence:** Identifier: CEG005260

**REFERENCES:** Von Loh, J., D. Cogan, J. Butler, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 2000. USGS-NPS Vegetation Mapping Program, Theodore Roosevelt National Park, North Dakota. USBR Technical Service Center, Technical Memorandum No. 8260-00-04. Denver, CO.

**V.B.2.N.a. LINARIA VULGARIS, CIRSIUM ARVENSE – MIXED FORBS HERBACEOUS ALLIANCE**

Butter-and-Eggs / Mixed Graminoids Semi-natural Herbaceous Vegetation Alliance [Provisional]

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**LINARIA VULGARIS / MIXED GRAMINOIDS SEMI-NATURAL HERBACEOUS VEGETATION [PROVISIONAL]**

Butter-and-Eggs / Mixed Graminoids Semi-natural Herbaceous Vegetation [Provisional]

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** Not applicable



## ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Palustrine

**Florissant Fossil Beds NM Environment:** *Linaria vulgaris* forms dense stands or patches, typically less than 0.25 ha in size, on upper floodplain terraces of flowing streams and in the bottom of moist swales. Groundwater is usually present within 25–50 cm of the soil surface. The distribution of *Linaria vulgaris* is generally at the lower elevations in drainages throughout the monument, where it occurs sporadically in patches with *Dasiphora fruticosa*, *Juncus balticus*, *Bromus inermis*, and *Cirsium arvense*.

**Global Environment:** Not applicable

## VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** *Linaria vulgaris* forms dense, but small, stands in association with *Dasiphora fruticosa*, *Juncus balticus*, *Bromus inermis*, and *Cirsium arvense*, among others. It is easily observed later in the growing season because of its medium-yellow-colored flowers. This exotic forb is between 0.5 and 1 m tall and may provide foliar cover from 50–55% in each patch. It is usually a component of another moist soil plant community. In one stand sampled, *Juncus balticus* was present at approximately 40% foliar cover and *Bromus inermis* at approximately 5% foliar cover; the plot was assigned to *Juncus balticus* Herbaceous Vegetation (CEGL001838). The ground cover is typically dense with litter, usually from 90–100% and up to 5 cm thick. Stands occur on nearly flat slopes of floodplain terraces and at nearly all aspects. Stands of *Linaria vulgaris* are being actively managed by monument staff, using a combination of mowing and herbicide application to stress the stands and to reduce seed production.

The aerial photo signature for stands of *Linaria vulgaris* are dark gray to black on true color photos.

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

## MOST ABUNDANT SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Dasiphora fruticosa</i>
Forb	<i>Linaria vulgaris</i>
Graminoid	<i>Juncus balticus</i> , <i>Bromus inermis</i>

**Global**

<u>Stratum</u>	<u>Species</u>
Forb	<i>Linaria vulgaris</i>

## CHARACTERISTIC SPECIES

**Florissant Fossil Beds NM**

<u>Stratum</u>	<u>Species</u>
Forb	<i>Linaria vulgaris</i> , <i>Cirsium arvense</i>
Graminoid	<i>Juncus balticus</i> , <i>Bromus inermis</i> , <i>Elymus repens</i>

**Global**

<u>Stratum</u>	<u>Species</u>
Forb	<i>Linaria vulgaris</i>

## OTHER NOTEWORTHY SPECIES

**Florissant Fossil Beds NM**

**Global**

<u>Stratum</u>	<u>Species</u>
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## GLOBAL SIMILAR ASSOCIATIONS:

*Cirsium arvense* Mixed Forbs Herbaceous Alliance

## GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** GW

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** This association is represented by small stands or patches along several drainages and moist swales in the monument, particularly along Grape Creek and its tributaries. The small stands occupy upper floodplain terraces, particularly oxbow bends, to the ecotone with upland vegetation.

**Global Range:** Not applicable

**Nations:** US

**States/Provinces:** CO

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** This was represented by one stand.

**Classification Confidence:** **Identifier:** Not determined

#### REFERENCES:

### V.B.2.N.?. PARONYCHIA SESSILIFLORA HERBACEOUS ALLIANCE [PROVISIONAL]

Nailwort Herbaceous Vegetation Alliance

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#### PARONYCHIA SESSILIFLORA HERBACEOUS VEGETATION [PROVISIONAL]

Nailwort Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** Not applicable

#### ENVIRONMENTAL DESCRIPTION

**USFWS Wetland System:** Upland

**Florissant Fossil Beds NM Environment:** This community occupies a shallow, northwest-facing (294°) scrape, covering approximately 0.25 hectare on a moderate slope of approximately 6%. The scrape was sufficiently deep to remove the topsoil, a dark gray layer supporting *Festuca arizonica* grassland around the disturbed site. The depth of the scrape ranged from a few centimeters to approximately 1m deep, and it contained fossilized tree fragments, broken pieces of shale, and crushed granite, in addition to gravelly soil.

**Global Environment:** Not applicable

#### VEGETATION DESCRIPTION

**Florissant Fossil Beds NM Vegetation:** The nailwort community is sparse, with approximately 10% vegetative cover. It is a collection of native, pioneering plants growing from coarse gravel subsoil exposed by excavation a number of years ago. It is unique, representing the only example of this land-use type observed, and it may provide a key to succession in similar areas for the most pioneering forb, dwarf-shrub, grass, and tree species. A few small *Pinus ponderosa* trees are present along with *Ericameria parryi*, *Artemisia frigida*, and *Gutierrezia sarothrae* dwarf-shrubs scattered across the scrape. The cespitose plants *Paronychia sessiliflora*, *Hymenoxys richardsonii*, *Cryptantha thyrsiflora*, and *Antennaria* sp. were scattered but common across the site. The grasses *Festuca arizonica*, *Koeleria macrantha*, *Elymus elymoides*, and *Bouteloua gracilis* were also present, but sparse. All of the dwarf-shrubs, forbs, and bunch grasses exhibit pedestaling, an indication of on-going erosion from the site, principally from raindrop splash and sheet run-off.

The aerial photo signature is white, from reflectance off of exposed soil.

**Global Vegetation:** Not applicable

**Global Dynamics:** Not applicable

#### MOST ABUNDANT SPECIES

##### Florissant Fossil Beds NM

##### Stratum

Dwarf-shrub

Forb

##### Species

*Ericameria parryi*

*Paronychia sessiliflora*, *Hymenoxys richardsonii*, *Oxytropis splendens*

Graminoid *Festuca arizonica*

**Global**  
**Stratum** **Species**

#### CHARACTERISTIC SPECIES

Florissant Fossil Beds NM

**Stratum** **Species**

Forb *Paronychia sessiliflora*, *Hymenoxys richardsonii*, *Oxytropis splendens*

Graminoid *Festuca arizonica*

Dwarf-shrub *Ericameria parryi*

Tree *Pinus ponderosa*

**Global**  
**Stratum** **Species**

#### OTHER NOTEWORTHY SPECIES

Florissant Fossil Beds NM

**Global**  
**Stratum** **Species**

#### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:**

**Global Classification Comments:**

#### ELEMENT DISTRIBUTION

**Florissant Fossil Beds NM Range:** The nailwort community was found on only one site, in close proximity to the water pipeline corridor, west of CR1. A shallow scrape that had been excavated historically was present, presumably in a search to find fossil rocks, possibly to remove a fossil trunk, or simply a gravel borrow pit.

**Global Range:** Not applicable

**Nations:**

**States/Provinces:**

#### ELEMENT SOURCES

**Florissant Fossil Beds NM Inventory Notes:** Plot 21

**Classification Confidence:** **Identifier:** Not determined.

**REFERENCES:**

## REFERENCES

- Alexander, B. G., Jr., E. L. Fitzhugh, F. Ronco, Jr., and J. A. Ludwig. 1987. A classification of forest habitat types of the northern portion of the Cibola National Forest, NM. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-143. Fort Collins, CO. 35 pp.
- Alexander, R. M. 1986. Classification of the forest vegetation of Wyoming. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Note RM-466. Fort Collins, CO. 10 pp.
- Andrews, T. 1983. Subalpine meadow and alpine vegetation of the upper Pecos River. USDA Forest Service, Southwestern Region. Report RM-51. Albuquerque, NM.
- Bader, E. H. 1932. The vegetation of the Mesa Verde National Park, Colorado. Unpublished thesis. University of Colorado, Boulder. 64 pp.
- Baker, W. L. 1980a. Alpine vegetation of the Sangre De Cristo Mountains, New Mexico: Gradient analysis and classification. Unpublished thesis. University of North Carolina, Chapel Hill. 55 pp.
- Baker, W. L. 1982b. Natural vegetation of the Piceance Basin, Colorado. Appendix D, pages 1-113 in: J. S. Peterson and W. L. Baker, editors. Inventory of the Piceance Basin, Colorado. Unpublished report for the Bureau Land Management, Craig, CO.
- Baker, W. L. 1983a. Alpine vegetation of Wheeler Peak, New Mexico, USA: Gradient analysis, classification, and biogeography. *Arctic and Alpine Research* 15(2):223-240.
- Baker, W. L. 1983c. Natural vegetation of part of northwestern Moffat County, Colorado. Unpublished report prepared for the State of Colorado Natural Areas Program, Department of Natural Resources, Denver by Colorado Natural Heritage Inventory, Denver.
- Baker, W. L. 1984a. A preliminary classification of the natural vegetation of Colorado. *Great Basin Naturalist* 44(4):647-676.
- Baker, W. L. 1989b. Classification of the riparian vegetation of the montane and subalpine zones in western Colorado. *Great Basin Naturalist* 49(2):214-228.
- Baker, W. L., and S. C. Kennedy. 1985. Presettlement vegetation of part of northwestern Moffat County, Colorado, described from remnants. *Great Basin Naturalist* 45(4):747-777.
- Baumann, T. G. 1978a. Winter ecology of bighorn sheep in the Mummy Range, Colorado. Unpublished thesis. Colorado State University, Fort Collins.
- Bellah, R. G., and L. C. Hulbert. 1974. Forest succession on the Republican River floodplain in Clay County, Kansas. *Southwestern Naturalist* 19(2):155-166.
- Benedict, N. B. 1983. Plant associations of subalpine meadows, Sequoia National Park, California. *Arctic and Alpine Research* 15(3):383-396.
- Bierly, K. F. 1972. Meadow and fen vegetation in Big Meadows, Rocky Mountain National Park. Unpublished thesis. Colorado State University, Fort Collins. 102 pp.
- Binkley, D. 1986. *Forest Nutrition Management*. John Wiley & Sons, Inc., New York, NY.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1968b. Vegetation and soils of the Crowley Creek Watershed. Nevada Agricultural Experiment Station Bulletin R-42. Reno. 60 pp.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1968c. Vegetation and soils of the Duckwater Watershed. Nevada Agricultural Experiment Station Bulletin R-40. Reno. 76 pp.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1969b. Vegetation and soils of the Coils Creek Watershed. Nevada Agricultural Experiment Station Bulletin R-48. Reno. 81 pp.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1969d. Vegetation and soils of the Pine and Mathews Canyon Watersheds. Nevada Agricultural Experiment Station Bulletin R-46. Reno. 111 pp.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1971. Vegetation and soils of the Rock Springs Watershed. Nevada Agricultural Experiment Station Bulletin R-83. Reno. 116 pp.

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---

- Bond, H. E. 1959. Revegetation and disintegration of pocket gopher mounds on Black Mesa, Colorado. Unpublished thesis. Colorado State University, Fort Collins.
- Bourgeron, P. S., and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.
- Bowman, W.D. and H. Steltzer. In press. Positive feedbacks to anthropogenic nitrogen deposition in Rocky Mountain alpine tundra. *Ambio*.
- Boyce, D. A. 1977. Vegetation of the South Fork of the White River Valley, Colorado. Unpublished dissertation. University of Colorado, Boulder. 312 pp.
- Briggs, G. M., and J. A. MacMahon. 1983. Alpine and subalpine wetland plant communities of the Uinta Mountains, Utah. *Great Basin Naturalist* 43(4):523-530.
- Brotherson, J. D., and S. J. Barnes. 1984. Habitat relationships of *Glaux maritima* in central Utah. *Great Basin Naturalist* 44(2):299-309.
- Bunin, J. E. 1975a. Aspen forests of the west slope of the Park Range, north-central Colorado. Unpublished paper presented at the 1975 AIBS/ESA Meetings, 17-22 August 1975, Oregon State University, Corvallis. 22 pp.
- Bunin, J. E. 1975c. The vegetation of the west slope of the Park Range, Colorado. Unpublished dissertation. University of Colorado, Boulder. 235 pp.
- Bunin, J. E. 1985. Vegetation of the City of Boulder, Colorado open space lands. Report prepared for the City of Boulder, Real Estate/Open Space, Boulder, CO. 114 pp.
- Buttery, R. F. 1955. Range conditions and trends resulting from winter concentrations of elk in Rocky Mountain National Park, Colorado. Unpublished thesis. Colorado Agricultural and Mechanical College, Fort Collins. 117 pp.
- Caicco, S. L., and C. A. Wellner. 1983n. Research Natural Area recommendation for Little Jacks Creek. Unpublished report prepared for USDI Bureau of Land Management, Boise District, Idaho by Idaho Natural Areas Coordinating Committee. 14 pp.
- Chapin, F.S., III, L.R. Walker, C.L. Fastie, and L.C. Sharman. 1994. Mechanisms of primary succession following deglaciation at Glacier Bay, Alaska. *Ecological Monographs* 64(2):149-175.
- Clary, W. P. 1978. Arizona fescue mountain rangelands. Pages 205-207 in: D. N. Hyder, editor. *Proceedings of the First International Rangeland Congress*, Denver, CO, 14-18 August 1978. Society for Range Management, Denver.
- Clary, W. P., and H. A. Pearson. 1969. Cattle preferences for forage species in northern Arizona. *Journal of Range Management* 22(2):114-116.
- Coenenberg, J. G., and E. J. Deput. 1979. Baseline wildlife studies, Crow Coal Lease, southeastern Montana, 1975-1978. Montana Agricultural Experiment Station, Reclamation Research Unit, Bozeman, MT. 133 pp.
- CONHP [Colorado Natural Heritage Program]. No date. Unpublished data on file. Boulder, CO.
- Colorado Natural Heritage Program (CNHP). 1999. Biological and Conservation Data (BCD) System. Data from field surveys. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Cooper, D. J., and T. R. Cottrell. 1990. Classification of riparian vegetation in the northern Colorado Front Range. Unpublished report prepared for The Nature Conservancy, Colorado Field Office, Boulder. 115 pp.
- Cooper, S. V., and B. L. Heidel. 1997. Population status and ecology of trembling aspen and black cottonwood communities on the Blackfeet Indian Reservation. Prepared for the Blackfeet Nation-Fish and Wildlife Department and the USDI Fish & Wildlife Service by Montana Natural Heritage Program, Helena, MT.
- Cooper, S. V., P. Lesica, R. L. DeVelice, and T. McGarvey. 1995. Classification of southwestern Montana plant communities with emphasis on those of Dillon Resource Area, Bureau of Land Management. Montana Natural Heritage Program, Helena, MT. 154 pp.
- Cooper, S., and R. Pfister. 1981. Forest habitat types of the Blackfeet Indian Reservation. Review Draft, 5/21/81, for Bureau of Indian Affairs, Wind River Agency, Fort Washakie, WY.
- Copeland, W. N. 1980a. The Lawrence Memorial Grassland Preserve, a biophysical inventory with management recommendations. June 1980. Unpublished report prepared by The Nature Conservancy Field Office, Portland, Oregon. 161 pp.

- Costello, D. F. 1944a. Natural revegetation of abandoned plowed land in the mixed prairie association of northeastern Colorado. *Ecology* 25:312-326.
- Costello, D. F. 1954. Vegetation zones in Colorado. Pages iii-x in: H. D. Harrington, editor. *Manual of the plants of Colorado*. Sage Books, Denver.
- Costello, D. F., and H. E. Schwan. 1946. Conditions and trends on ponderosa pine ranges in Colorado. USDA Forest Service Mimeograph. 33 pp.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Service Program. FWS/OBS-79/31. Washington, DC. 103 pp.
- Cox, B. J. 1968. A vegetational comparison of the Gothic and Galena Mountain area. *Transactions of the Missouri Academy of Science* 2:72-83.
- Cox, C. F. 1933. Alpine plant succession on James Peak, Colorado. *Ecological Monographs* 3:299-372.
- Crawford, R. C. 2001. Initial riparian and wetland classification and characterization of the Columbia Basin in Washington. Prepared for Environmental Protection Agency and Bureau of Land Management, Spokane District. Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia. 83 pp.
- Crouch, G. L. 1983. Effects of commercial clear-cutting of aspen on understory vegetation and wildlife habitat values in southwestern Colorado. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-246. Fort Collins, CO.
- Crowe, E. A., and R. R. Clausnitzer. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. USDA Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-22-97.
- Currie, P. O. 1975. Grazing management of ponderosa pine - bunchgrass ranges of the central Rocky Mountains: The status of our knowledge. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-159. Fort Collins, CO. 24 pp.
- Curry, R. R. 1962. Geobotanical correlations in the alpine and subalpine regions of the Tenmile Range, Summit County, Colorado. Unpublished thesis. University of Colorado, Boulder. 133 pp.
- DeByle, N. V. 1985. Managing wildlife habitat with fire in the aspen ecosystem. Pages 73-82 in: *Fire's effects on wildlife habitat-Symposium proceedings*. USDA Forest Service General Technical Report INT-186. Intermountain Research Station, Ogden, UT.
- DeByle, N. V. 1989. Aspen ecology and management in the western United States. Pages 11-20 in: *USDA Forest Service General Technical Report*.
- DeByle, N. V., and R. P. Winokur, editors. 1985. *Aspen: Ecology and management in the western United States*. USDA Forest Service General Technical Report RM-119. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 283 pp.
- DeVelice, R. L. 1983. Forest vegetation of northern New Mexico and southern Colorado. Unpublished dissertation. New Mexico State University, Las Cruces. 191 pp.
- DeVelice, R. L., and J. A. Ludwig. 1983a. Climax forest series of northern New Mexico and southern Colorado. Pages 45-53 in: *Proceedings of the Workshop on Southwestern Habitat Types, 6-8 April 1983, Albuquerque, NM*. USDA Forest Service, Southwest Region, Albuquerque, NM.
- DeVelice, R. L., J. A. Ludwig, W. H. Moir, and F. Ronco, Jr. 1986. A classification of forest habitat types of northern New Mexico and southern Colorado. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-131. Fort Collins, CO. 59 pp.
- Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.
- Dick-Peddie, W. A. 1993. *New Mexico vegetation: Past, present, and future*. University of New Mexico Press, Albuquerque. 244 pp.
- Dorn, R. D. 1969. Relations of moose, cattle and willows in southwestern Montana. Unpublished thesis. Montana State University, Bozeman. 79 pp.
- Dorn, R. D. 1997. Rocky Mountain region willow identification field guide. Renewable Resources R2-RR-97-01. USDA Forest Service, Rocky Mountain Region, Denver, CO. 107 pp.

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---

- Driscoll, R. S., D. L. Merkel, D. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service. Miscellaneous Publication No. 1439. Washington, DC. 56 pp.
- Edwards, M. and W. Weber. 1990. Plants of Florissant Fossil Beds National Monument. Colorado Natural Heritage Program Technical Report. Boulder, CO.
- Evans, S. 1989a. Riparian survey of Washington's Columbia Basin. Unpublished report prepared for The Nature Conservancy Washington Natural Heritage Program, Olympia, Washington.
- Evenden, A. G. 1990. Ecology and distribution of riparian vegetation in the Trout Creek Mountains of southeastern Oregon. Ph.D. dissertation. Oregon State University, Corvallis. 156 pp.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
- Faber-Langendoen, D., and Midwest State Natural Heritage Program Ecologists. 1996. Terrestrial vegetation of the midwest United States. International classification of ecological communities: Terrestrial vegetation of the United States. The Nature Conservancy, Arlington, VA.
- Faber-Langendoen, D., editor. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp. plus appendix (705 pp.).
- Ferchau, H. A. 1973. Vegetation inventory analysis & impact study of the Parachute Creek area, Garfield County, Colorado. Part II, Volume 1, Chapter VI:1-77 in: Unpublished Colony Environmental Report for Colony Develop. Operation, Denver, prepared by Thorne Ecological Institute, Boulder.
- Fischer, W. C., and A. F. Bradley. 1987. Fire ecology of western Montana forest habitat types. USDA Forest Service General Technical Report INT-223. Intermountain Research Station, Ogden, UT. 95 pp.
- Fish, E. B. 1966. Secondary succession on upper Kiowa Creek watershed. Unpublished thesis. Colorado State University, Fort Collins. 102 pp.
- Fitzhugh, E. L., W. H. Moir, J. A. Ludwig, and F. Ronco, Jr. 1987. Forest habitat types in the Apache, Gila, and part of the Cibola national forests. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-145. Fort Collins, CO. 116 pp.
- Flowers, S. 1962. Vegetation of Morrow Point and Blue Mesa Reservoir basins of the upper Gunnison River, Colorado. Pages 47-102 in: A. M. Woodbury, editor. Ecological studies of the flora and fauna of the Curecanti Reservoir Basins, western Colorado. University of Utah, Anthropological Papers No. 59 (Upper Colo. Series No. 8).
- Foti, T., M. Blaney, X. Li, and K. G. Smith. 1994. A classification system for the natural vegetation of Arkansas. Proceedings of the Arkansas Academy of Science 48:50-53.
- Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-8. Portland, OR. 417 pp.
- Fuller, G. D. 1930. A comparison of certain Rocky Mountain grasslands with the prairie of Illinois. Transactions of the Illinois Academy of Science 8:121-130.
- Giese, T. G. 1975. The ecology of the Middle Blue River Valley, Summit County, Colorado, with an analysis of modifications due to powerline construction. Unpublished thesis. University of Colorado, Boulder. 109 pp.
- Girard, M. M., H. Goetz, and A. J. Bjugstad. 1989. Native woodland habitat types of southwestern North Dakota. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-281. Fort Collins, CO. 36 pp.
- Girard, M., D.L. Wheeler, and S.B. Mills. 1995. Classification of riparian communities on the Bighorn National Forest. USDA Forest Service draft manuscript. Rocky Mountain Region, Lakewood, CO.
- Hall, F. C. 1973. Plant communities of the Blue Mountains in eastern Oregon and southeastern Washington. USDA Forest Service, Pacific Northwest Region. R6 Area Guide 3-1. 62 pp.
- Hall, H. H. 1971. Ecology of a subalpine meadow of the Aquarius Plateau, Garfield and Wayne counties, Utah. Unpublished dissertation. Brigham Young University, Provo, UT.
- Hall, J. B., and P. L. Hansen. 1997. A preliminary riparian habitat type classification system for the Bureau of Land Management districts in southern and eastern Idaho. Riparian and Wetland Research Program, School of Forestry, University of Montana. Idaho Bureau of Land Management, Technical Bulletin No. 97-11. 381 pp.

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---

- Hanks, J. P., E. L. Fitzhugh, and S. R. Hanks. 1983. A habitat type classification system for ponderosa pine forests of northern Arizona. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-97. Fort Collins, CO. 22 pp.
- Hansen, P. L., G. R. Hoffman, and A. J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-113. Fort Collins, CO. 35 pp.
- Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Miscellaneous Publication No. 54. 646 pp.
- Hansen, P. L., S. W. Chadde, and R. D. Pfister. 1988b. Riparian dominance types of Montana. University of Montana Miscellaneous Publication 49. Montana Forest and Conservation Experiment Station, Missoula. 411 pp.
- Hansen, P., K. Boggs, and R. Pfister. 1991. Classification and management of riparian and wetland sites in Montana. Unpublished draft version prepared for Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula. 478 pp.
- Hansen, P., R. Pfister, J. Joy, D. Svoboda, K. Boggs, L. Myers, S. Chadde, and J. Pierce. 1989. Classification and management of riparian sites in southwestern Montana. Unpublished draft prepared for the Montana Riparian Association, School of Forestry, University of Montana, Missoula. 292 pp.
- Hansen, P., S. Chadde, R. Pfister, J. Joy, D. Svoboda, J. Pierce, and L. Myers. 1988a. Riparian site types, habitat types, and community types of southwestern Montana. Draft Version 1. Montana Riparian Association, Missoula.
- Hess, K. 1981. Phyto-edaphic study of habitat types of the Arapaho-Roosevelt National Forest, Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 558 pp.
- Hess, K., and C. H. Wasser. 1982. Grassland, shrubland, and forest habitat types of the White River-Arapaho National Forest. Unpublished final report 53-82 FT-1-19. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 335 pp.
- Hess, K., and R. R. Alexander. 1986. Forest vegetation of the Arapaho and Roosevelt national forests in northcentral Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-266. Fort Collins, CO. 48 pp.
- Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. *The Southwestern Naturalist* 45(4):385-420.
- Hoagland, B. W. 1998. Oklahoma riparian vegetation. In: A. Fallon and M. Smolen, editors. *Riparian area management handbook*. Publication number E-952. Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater.
- Hoffman, G. R., and R. R. Alexander. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: A habitat type classification. USDA Forest Service Research Paper RM-170. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 38 pp.
- Hoffman, G. R., and R. R. Alexander. 1980. Forest vegetation of the Routt National Forest in northwestern Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-221. Fort Collins, CO. 41 pp.
- Hoffman, G. R., and R. R. Alexander. 1983. Forest vegetation of the White River National Forest in western Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-249. Fort Collins, CO. 36 pp.
- Hoffman, G. R., and R. R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-276. Fort Collins, CO. 48 pp.
- Holland, R. F. 1986b. Preliminary descriptions of the terrestrial natural communities of California. Unpublished report prepared for the California Department of Fish and Game, Nongame-Heritage Program and Natural Diversity Database, Sacramento. 156 pp.
- Johnson, K. R. 1932a. Plant ecology of a glacial lake. *Journal of the Colorado-Wyoming Academy of Science* 1(4):13. [Abstract]
- Johnson, K. R. 1932b. Ecology of a glacial lake in central Colorado. Unpublished thesis. University of Colorado, Boulder. 30 pp.
- Johnson, K. R. 1936. Ecology of a glacial lake in central Colorado. *University of Colorado Studies* 23(3):235-243.



- Johnson, K. R. 1939. Plant ecology of northwestern Colorado lakes and surrounding areas. Unpublished dissertation. University of Colorado, Boulder. 138 pp.
- Johnson, K. R. 1941. Vegetation of some mountain lakes and shores in northwestern Colorado. *Ecology* 22:306-316.
- Johnson, W. M. 1945. Natural revegetation of abandoned crop land in the ponderosa pine zone of the Pike's Peak region in Colorado. *Ecology* 26:363-374.
- Johnson, W. M. 1953. Effect of grazing intensity upon vegetation and cattle gains on ponderosa pine-bunchgrass ranges of the Front Range of Colorado. USDA Circular Number 929. 36 pp.
- Johnson, W. M. 1956a. The effect of grazing intensity on plant composition, vigor, and growth of pine-bunchgrass ranges in central Colorado. *Ecology* 37:790-798.
- Johnson, W. M., and C. H. Niederhof. 1941. Some relationships of plant cover to run-off, erosion, and infiltration on granitic soils. *Journal of Forestry*. 39:854-858.
- Johnson, W. M., and E. H. Reid. 1958. Herbage utilization on pine-bunchgrass ranges of Colorado. *Journal of Forestry* 56:647-651.
- Johnson, W. M., and E. H. Reid. 1964. Range condition classification of bunchgrass range at the Manitou Experimental Forest in Colorado. *Journal of Range Management* 17:137-141.
- Johnson, W. M., and G. E. Klipple. 1946. The natural revegetation of abandoned cropland in the ponderosa pine zone of the Pike's Peak region. *Journal of the Colorado-Wyoming Academy of Science* 3(3):39-40. [Abstract]
- Johnston, B. C. 1987. Plant associations of Region Two: Potential plant communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region. Lakewood, CO. 429 pp.
- Johnston, B. C., and L. Hendzel. 1985. Examples of aspen treatment, succession and management in western Colorado. USDA Forest Service, Range Wildlife Fisheries and Ecology. Denver, CO. 164 pp.
- Jones, G. 1992b. Wyoming plant community classification (Draft). Wyoming Natural Diversity Database, Laramie, WY. 183 pp.
- Jones G. 1992. A preliminary classification of riparian vegetation types of the Medicine Bow Range and the Sierra Madre. Report submitted to the Medicine Bow National Forest. Wyoming Natural Diversity Database (The Nature Conservancy), Laramie, WY.
- Jones, G. P., and G. M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Submitted to Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database, Laramie, WY. 245 pp.
- Kahler, L. J. 1973. Correlation of slope exposure with differences in the composition of the vegetation community at 7000 feet in Clear Creek Canyon west of Golden, Colorado. Unpublished thesis. University of Colorado, Boulder. 105 pp.
- Kartesz, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Second edition. Volume 1--Checklist. Timber Press, Portland, OR. 622 pp.
- Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: J. T. Kartesz and C. A. Meacham. *Synthesis of the North American Flora*, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.
- Keammerer, W. R., and R. E. Stoecker. 1975. Vegetation and wildlife studies along proposed corridors for oil shale tract C-b. Unpublished report prepared for Shell Oil Co., Denver, by Stoecker-Keammerer and Associates, Boulder, CO. 86 pp.
- Keammerer, W. R., and R. E. Stoecker. 1980. Vegetation and wildlife studies for the Mount Emmons project. Unpublished report prepared for AMAX Environmental Services, Inc., by Stoecker-Keammerer and Associates, Ecological Consultants, Boulder, CO. 3 volumes.
- Keammerer, W. R., and S. J. Peterson. 1981. Vegetation studies on the Naval Oil Shale Reserve. Unpublished report prepared for TRW Energy Systems Group, McLean, Virginia, by Stoecker-Keammerer and Associates, Ecological Consultants, Boulder, CO. 77 pp.
- Kerr, C. W., and J. A. Henderson. 1979. Upland vegetation classification and map for a test area, Manti-La Sal National Forest. Appendix Report 15 in: J. A. Henderson, L. S. Davis, and E. M. Ryberg, editors. *ECOSYM: A classification and information system for wildlife resource management*. Utah State University, Logan. 53 pp.
- Kettler, S., and A. McMullen. 1996. Routt National Forest riparian vegetation classification. Report prepared for Routt National Forest by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

- Kittel, G. M., and N. D. Lederer. 1993. A preliminary classification of the riparian vegetation of the Yampa and San Miguel/Dolores river basins. Unpublished report prepared for Colorado Department of Health and the Environmental Protection Agency by The Nature Conservancy, Colorado Field Office, Boulder.
- Kittel, G., E. Van Wie, and M. Damm. 1997. A classification of the riparian vegetation of the South Platte Basin (and part of Republican River Basin), Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson. 1999. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Kittel, G., R. Rondeau, and A. McMullen. 1996. A classification of the riparian vegetation of the Lower South Platte and parts of the Upper Arkansas River basins, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Fort Collins. 243 pp.
- Kittel, G., R. Rondeau, and S. Kettler. 1995. A classification of the riparian vegetation of the Gunnison River Basin, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Prepared by Colorado Natural Heritage Program, Fort Collins. 114 pp.
- Kittel, G., R. Rondeau, N. Lederer, and D. Randolph. 1994. A classification of the riparian vegetation of the White and Colorado River basins, Colorado. Final report submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Colorado Natural Heritage Program, Boulder. 166 pp.
- Knight, D. H. 1994. Mountains and plains: Ecology of Wyoming landscapes. Yale University Press, New Haven, MA. 338 pp.
- Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation. University of Colorado, Boulder. 655 pp.
- Komarkova, V. 1986. Habitat types on selected parts of the Gunnison and Uncompahgre national forests. Unpublished final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 270 pp. plus appendices.
- Komarkova, V. K., R. R. Alexander, and B. C. Johnston. 1988b. Forest vegetation of the Gunnison and parts of the Uncompahgre national forests: A preliminary habitat type classification. USDA Forest Service. Research Paper RM-163. 65 pp.
- Komarkova, V., A. Peters, G. Kamani, W. Jones, V. Howard, H. Gordon, and K. Southwick. 1988a. Natural recovery of plant communities on disturbance plots and history of land use in the Niwot Ridge/Green Lakes Valley, Front Range, Colorado. University of Colorado Longterm Ecological Research Working Paper 88/1. Boulder, CO. 46 pp.
- Kovalchik, B. L. 1987. Riparian zone associations - Deschutes, Ochoco, Fremont, and Winema national forests. USDA Forest Service Technical Paper 279-87. Pacific Northwest Region, Portland, OR. 171 pp.
- Kovalchik, B. L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.
- Kovalchik, B.L., W.E. Hopkins and S.J. Brunsfeld. 1988. Major Indicator Shrubs and Herbs in Riparian Zones on National Forests of Central Oregon. USDA Forest Service R6-ECOL-TP-005-88. Pacific Northwest Region, Bend, OR.
- Kovalchik, B.L. and W. Elmore. 1992. Effects of cattle grazing systems on willow-dominated plant associations in central Oregon. In W.P. Clary, E.D. McArthur, D. Bedunah, and C.L. Wambolt, compilers. Proceedings-Symposium on Ecology and Management of Riparian Shrub Communities, May 29-31, 1991, Sun Valley, ID. USDA Forest Service General Technical Report INT-289. Intermountain Forest & Range Experiment Station. Ogden, UT. 232 pp.
- Langenheim, J. H. 1962. Vegetation and environmental patterns in the Crested Butte area, Gunnison County, Colorado. Ecological Monographs 32:249-285.
- Larson, M., and W. H. Moir. 1987. Forest and woodland habitat types of northern New Mexico and northern Arizona. Edition 2. USDA Forest Service, Southwestern Region, Albuquerque, NM.
- Lee, L. C., and C. J. Jonkel. 1980. The vegetation structure and ecology of grizzly bear habitat in the Pine and Antelope Butte Wetlands, Montana. Unpublished Border Grizzly Project Special Report 36. University of Montana, Missoula. 63 pp.
- Lewis, M. E. 1970. Alpine rangelands of the Uinta Mountains, Ashley and Wasatch national forests, Region 4 of the USDA Forest Service. Unpublished report mimeographed for USDA Forest Service, Region IV, Ogden, UT. 75 pp.

**USGS-NPS Vegetation Mapping Program**  
**Florissant Fossil Beds National Monument**

---

- Lewis, M. E. 1975. Plant communities of the Jarbidge Mountain Complex, Humboldt National Forest. Unpublished report compiled for USDA Forest Service, Region IV, Ogden, UT. 22 pp.
- Looman, J. 1982. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation, Part 2. Freshwater marshes and bogs. *Phytocoenologia* 10(4):401-423.
- Looman, J. 1983. 111 range and forage plants of the Canadian prairies. Research Branch, Agriculture Canada Publication 1751.
- Loope, L. L. 1969. Subalpine and alpine vegetation of northeastern Nevada. Unpublished thesis. Duke University, Durham, NC.
- Loveless, C. M. 1963. Ecological characteristics of a selected mule deer winter range. Unpublished dissertation. Colorado State University, Fort Collins. 318 pp.
- Loveless, C. M. 1967. Ecological characteristics of a mule deer winter range. Colorado Department of Game, Fish and Parks Technical Publication 20. 125 pp.
- Lynn, R., M. Larson, D. Hoeft, L. Todd, T. Raetz, L. Fager, and G. Barranco. No date. Black Hills National Forest ecological land units study. USDA Forest Service, Black Hills National Forest, SD.
- Manning, M. 1988. Ecology and rooting characteristics of four intermountain meadow community types. Unpublished thesis. University of Nevada, Reno.
- Manning, M. E., and W. G. Padgett. 1995. Riparian community type classification for Humboldt and Toiyabe national forests, Nevada and eastern California. USDA Forest Service, Intermountain Region. 306 pp.
- Marr, J. W., D. A. Boyce, and J. W. Todd. 1973b. Preliminary report on the Redcliff project, Eagle County, Colorado. Unpublished report to the D. E. Fleming Company, Denver, and the Colorado River Water Conservation District, Glenwood Springs, by University of Colorado, Boulder. 9 pp.
- Marr, J. W., D. Buckner, and C. Mutel. 1973a. Ecological analyses of potential shale oil products pipeline corridors in Colorado and Utah. Unpublished report prepared for Colony Development Operation, Atlantic Richfield Company, Denver, by Thorne Ecological Institute and University of Colorado, Boulder. 96 pp. plus appendices.
- Marriott, H. J., and D. Faber-Langendoen. 2000. The Black Hills community inventory. Volume 2: Plant community descriptions. The Nature Conservancy, Midwest Conservation Science Center and Association for Biodiversity Information, Minneapolis, MN. 326 pp.
- Mattson, D. J. 1984. Classification and environmental relationships of wetland vegetation in central Yellowstone National Park. Unpublished thesis. University of Idaho, Moscow. 409 pp.
- McIntosh, A. C. 1923. Vegetation at different elevations in Boulder Canyon. Unpublished thesis. University of Colorado, Boulder. 35 pp.
- Merkle, J. 1962. Plant communities of the Grand Canyon area, Arizona. *Ecology* 43(4):698-711.
- MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.
- Moir, W. H., and J. A. Ludwig. 1979. A classification of spruce-fir and mixed conifer habitat types of Arizona and New Mexico. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-207. Fort Collins, CO. 47 pp.
- Morgan, M. D. 1969. Ecology of aspen in Gunnison County, Colorado. *The American Midland Naturalist* 82(1):204-228.
- MTNHP [Montana Natural Heritage Program]. No date. Unpublished data on file. Helena, MT.
- Mueggler, W. F. 1988. Aspen community types of the Intermountain Region. USDA Forest Service General Technical Report INT-250. Intermountain Research Station, Ogden, UT. 135 pp.
- Mueggler, W. F., and R. B. Campbell, Jr. 1982. Aspen community types on the Caribou and Targhee national forests in southeastern Idaho. USDA Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-294. Ogden, UT. 32 pp.
- Mueggler, W. F., and R. B. Campbell, Jr. 1986. Aspen community types of Utah. USDA Forest Service Research Paper INT-362, Intermountain Forest and Range Experiment Station, Ogden, UT.
- Muldavin, E., P. Durkin, M. Bradley, M. Stuever, and P. Mehlhop. 2000a. Handbook of wetland vegetation communities of New Mexico: Classification and community descriptions (volume 1). Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico, Albuquerque, NM.

- Murphy, P. H. 1982. The forest vegetation of the Lost Creek area in the southern Front Range, Colorado. Unpublished thesis. University of Colorado, Boulder. 145 pp.
- Mutel, C. F. 1973. An ecological study of the plant communities of certain montane meadows in the Front Range of Colorado. Unpublished thesis. University of Colorado, Boulder. 77 pp.
- Mutel, C. F. 1976. From grassland to glacier: An ecology of Boulder County, Colorado. Johnson Publishing Company, Boulder. 169 pp.
- Mutel, C., and J. W. Marr. 1973. A vegetative study of three montane herbaceous basins. *Journal of the Colorado-Wyoming Academy of Science* 7(4):28. (Abstract)
- Mutz, K. M., and J. Queiroz. 1983. Riparian community classification for the Centennial Mountains and South Fork Salmon River, Idaho. Unpublished report prepared for USDA Forest Service Intermountain Region under contract 53-84M8-2-0048 by Meiji Resource Consultants, Layton, UT. 168 pp.
- Mutz, K. M., and R. Graham. 1982. Riparian community type classification-Big Piney Range District, Wyoming. Unpublished report prepared for USDA Forest Service, Intermountain Region under contract 53-84M8-1-974, by Meiji Resource Consultants, Layton, UT. 88 pp.
- Nachlinger, J. L. 1985. The ecology of subalpine meadows in the Lake Tahoe region, California and Nevada. Unpublished thesis. University of Nevada, Reno. 151 pp.
- Nichol, A. A. 1937. The natural vegetation of Arizona. *University of Arizona Agricultural Experiment Station Technical Bulletin* 68:177-222.
- Norton, B. E., J. Tuhy, and S. Jensen. 1981. Riparian community classification for the Grey's River, Wyoming. Unpublished final report prepared by Department of Range Science, Utah State University, Logan for USDA Forest Service, Region 4, Ogden, UT. 188 pp.
- Olson, R. A., and W. A. Gerhart. 1982. A physical and biological characterization of riparian habitat and its importance to wildlife in Wyoming. Unpublished report prepared for Wyoming Fish and Game Department, Cheyenne, WY. 188 pp.
- Padgett, W. G. 1982. Ecology of riparian plant communities in southern Malheur National Forest. Unpublished thesis. Oregon State University, Corvallis. 143 pp.
- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1988b. Riparian community type classification of Utah. USDA Forest Service, Intermountain Region Publication R4-ECOL-88-01. Ogden, UT.
- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region. Report R4-ECOL-89-01. Ogden, UT. 191 pp.
- Padgett, W. G., and M. E. Manning. 1988. Preliminary riparian community type classification for Nevada. Draft. Unpublished report prepared for USDA Forest Service Region IV, Intermountain Region Ecology and Classification Program, Ogden, UT.
- Palmer, E. J. 1929. The ligneous flora of the Davis Mountains. *Journal of Arnold Arboretum* 10:8-45.
- Paulsen, H. A., Jr. 1969. Forage values on a mountain grassland-aspen range in western Colorado. *Journal of Range Management* 22:102-107.
- Peet, R. K. 1975. Forest vegetation of the east slope of the northern Colorado Front Range. Unpublished dissertation. Cornell University, Ithaca, NY.
- Peet, R. K. 1981. Forest vegetation of the Colorado Front Range. *Vegetatio* 45:3-75.
- Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service. General Technical Report INT-34. Intermountain Forest and Range Experiment Station, Ogden, UT. 174 pp.
- Phillips, C. M. 1977. Willow carrs of the upper Laramie River Valley, Colorado. Unpublished thesis. Colorado State University, Fort Collins. 71 pp.
- Plumb, G. A. 1988. An algorithmic approach to automated vegetation mapping of Big Bend National Park, Texas. Ph.D. dissertation. University of Kansas, Lawrence. 449 pp.
- Potter, L. D., and D. R. Moir. 1961. Phytosociological study of burned and unburned deciduous woods, Turtle Mountains, North Dakota. *Ecology* 42:468-480.

- Powell, D. C. 1988a. Aspen community types of the Pike and San Isabel national forests in south-central Colorado. USDA Forest Service, Rocky Mountain Region, Report R2-ECOL-88-01. 254 pp.
- Ramaley, F. 1915. The relative importance of different species in a mountain grassland. *Botanical Gazette* 60:154-157.
- Ramaley, F. 1916a. Quadrat studies in a mountain grassland. *Botanical Gazette* 62:70-74.
- Ramaley, F. 1916b. Dry grassland of a high mountain park in northern Colorado. *The Plant World* 19(4):249-270.
- Ramaley, F. 1919a. The role of sedges in some Colorado plant communities. *American Journal of Botany* 6:120-130.
- Ramaley, F. 1920. Subalpine lake-shore vegetation in north central Colorado. *American Journal of Botany* 7:57-74.
- Ramaley, F. 1942. Vegetation of the San Luis Valley in southern Colorado. *University of Colorado Studies, Series D*, 1:231-277.
- Ramaley, F., and W. W. Robbins. 1909. Studies in lake and streamside vegetation. I. Redrock Lake near Ward, Colorado. *University of Colorado Studies* 6:133-168.
- Rector, C. D. 1979. Lower Gunnison River Basin wetland inventory and evaluation. Unpublished thesis. University of Colorado, Boulder. 71 pp.
- Reed, R. M. 1971. Aspen forests of the Wind River Mountains, Wyoming. *The American Midland Naturalist* 86(2):327-343.
- Reid, E. H., and L. D. Love. 1951. Range-watershed conditions and recommendations for management, Elk Ridge and Lower Elk Ridge cattle allotments, Roosevelt National Forest, Colorado. Unpublished report prepared for USDA Forest Service. 123 pp.
- Reid, W. H. 1974. Analysis of plant ecological systems through simulation of individual organisms. Unpublished dissertation. University of Colorado, Boulder. 265 pp.
- Richard, C., G. Kittel, and S. Kettler. 1996. A classification of the riparian vegetation of the San Juan National Forest. Draft 1 report. Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Robbins, W. W. 1918. Successions of vegetation in Boulder Park, Colorado. *Botanical Gazette* 65(6):493-525.
- Roberts, D. W., D. W. Wight, and G. P. Hallsten. 1992. Plant community distribution and dynamics in Bryce Canyon National Park. Unpublished final report for Bryce Canyon National Park Project PX1200-7-0966. 146 pp.
- Rominger, J. M., and L. A. Paulik. 1983. A floristic inventory of the plant communities of the San Francisco Peaks Research Natural Area. USDA Forest Service General Technical Report RM-96. Rocky Mountain Forest and Range Experiment Station, Ft Collins, CO. 9 pp.
- Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.
- Sanderson, J., and M. March. 1996. Extreme rich fens of South Park, Colorado: Their distribution, identification, and natural heritage significance. Report submitted to Park County, the Colorado Department of Natural Resources, and the Environmental Protection Agency. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Sanderson, J., and S. Kettler. 1996. A preliminary wetland vegetation classification for a portion of Colorado's west slope. Report prepared for Colorado Department of Natural Resources, Denver, CO, and U.S. Environmental Protection Agency, Region VIII, Denver, CO. Colorado Natural Heritage Program, Ft. Collins, CO. 243 pp.
- Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento. 471 pp.
- Schlatterer, E. F. 1972. A preliminary description of plant communities found on the Sawtooth, White Cloud, Boulder, and Pioneer mountains. Unpublished report prepared for USDA Forest Service, Intermountain Region, Ogden, UT. 111 pp.
- Severson, K. E., and J. F. Thilenius. 1976. Classification of quaking aspen stands in the Black Hills and Bear Lodge Mountains. USDA Forest Service Research Paper RM-166. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 24 pp.
- Seyer, S. C. 1979. Vegetative ecology of a montane mire, Crater Lake National Park, Oregon. Unpublished thesis. Oregon State University, Corvallis. 87 pp.
- Shanks, D. L. 1977. Aerial photo densitometry for rangeland planning and evaluation. Unpublished thesis. Colorado State University, Fort Collins. 66 pp.
- Shepherd, H. R. 1975. Vegetation of two dissimilar bighorn sheep ranges in Colorado. *Colorado Division of Wildlife Report* 4. 223 pp.
- Shepperd, W. D. 1990. Initial growth, development, and clonal dynamics of regenerated aspen in the Rocky Mountains. USDA Forest Service Research Paper RM-312. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 8 pp.

**USGS-NPS Vegetation Mapping Program**  
**Florissant Fossil Beds National Monument**

---

- Shupe, J. B., J. D. Brotherson, and S. R. Rushforth. 1986. Patterns of vegetation surrounding springs in Goshen Bay, Utah County, Utah, U.S.A. *Hydrobiologia* 139:97-107.
- Smith, D. R. 1967. Effects of cattle grazing on a ponderosa pine-bunchgrass range in Colorado. USDA Forest Service. General Technical Bulletin 1371. 60 pp.
- Soil Conservation Service. 1978. Range site descriptions for Colorado. Technical Guide, Section II-E. USDA Soil Conservation Service, Colorado State Office, Denver.
- Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. USDA Forest Service General Technical Report INT-114. Intermountain Forest and Range Experiment Station, Ogden, UT. 138 pp.
- Steele, R., S. V. Cooper, D. M. Ondov, D. W. Roberts, and R. D. Pfister. 1983. Forest habitat types of eastern Idaho - western Wyoming. USDA Forest Service General Technical Report INT-144. Intermountain Forest and Range Experiment Station, Ogden, UT. 122 pp.
- Steinauer, G. 1989. Characterization of the natural communities of Nebraska. Appendix D, pages 103-114 in: M. Clausen, M. Fritz, and G. Steinauer. The Nebraska Natural Heritage Program, two year progress report. Unpublished document. Nebraska Game and Parks Commission, Natural Heritage Program, Lincoln, NE.
- Steinauer, G., and S. Rolfsmeier. 2000. Terrestrial natural communities of Nebraska. Unpublished report of the Nebraska Game and Parks Commission. Lincoln, NE. 143 pp.
- Stewart, B. K. 1940. Plant ecology and paleoecology of the Creede Valley, Colorado. Unpublished dissertation. University of Colorado, Boulder. 154 pp.
- Swift, R. L. 1974. Vegetation-site relations of ponderosa pine forest in the Front Range of central Colorado. Unpublished thesis. Colorado State University, Fort Collins. 121 pp.
- Terwilliger, C., Jr., K. Hess, and C. H. Wasser. 1979b. The habitat types of Region II. USDA Forest Service: A preliminary list and description. Unpublished initial progress report for Habitat Type Classification, Region 2, USDA Forest Service.
- Terwilliger, C., K. Hess, and C. Wasser. 1979a. Key to the preliminary habitat types of Region 2. Addendum to initial progress report for habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.
- Thilenius, J. F. 1971. Vascular plants of the Black Hills of South Dakota and adjacent Wyoming. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-71. Fort Collins, CO.
- Thilenius, J. F. 1972. Classification of the deer habitat in the ponderosa pine forest of the Black Hills, South Dakota. USDA Forest Service Research Paper RM-91. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 28 pp.
- Thompson, J. 2001. Draft vegetation associations of Zion National Park, Utah. Prepared for Association for Biodiversity Information, Boulder.
- Trlica, M. J., and P. Hackney. 1977. Vegetative and wildlife inventory of Sommerville Table. Unpublished report prepared for the USDI Bureau of Land Management, Royal Gorge Resource Area Canon City, CO. 20 pp.
- Tuhy, J. S. 1981. Stream bottom community classification for the Sawtooth Valley, Idaho. Unpublished thesis. University of Idaho, Moscow. 230 pp.
- Tuhy, J. S., and S. Jensen. 1982. Riparian classification for the Upper Salmon and Middle Fork Salmon River drainages, Idaho. Unpublished report prepared for the USDA Forest Service, Intermountain Region by White Horse Associates, Smithfield, UT. 183 pp.
- Ueckert, D. N. 1968. Diets of some grasshoppers common on mountain herbland in northern Colorado. Unpublished thesis. Colorado State University, Fort Collins. 37 pp.
- UNESCO [United Nations Educational, Scientific and Cultural Organization]. 1973. International classification and mapping of vegetation. Series 6, Ecology and Conservation. United Nations Educational, Scientific, and Cultural Organization. Paris. 93 pp.
- USFS [U.S. Forest Service]. 1983b. Plant associations of Region Two. Third edition. USDA Forest Service, Region Two, Range, Wildlife, and Ecology, Denver, CO. 379 pp.
- Van Cleve, K., L.A. Viereck, and R.L. Schlentner. 1971. Accumulation of nitrogen in alder (*Alnus*) ecosystems near Fairbanks, Alaska. *Arctic and Alpine Research* 3(2):101-114.

**USGS-NPS Vegetation Mapping Program**  
**Florissant Fossil Beds National Monument**

---

- Viereck, L.A. 1970. Forest succession and soil development adjacent to the Chena River in interior Alaska. *Arctic and Alpine Research* 2(1):1-26.
- Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. General Technical Report PNW-GTR-286. Pacific Northwest Research Station, Portland, OR.
- Von Loh, J. 2000. Draft local descriptions of the vegetation associations of Ouray National Wildlife Refuge. USGS Bureau of Reclamation, Remote Sensing and GIS Group, Denver Federal Center, Denver.
- Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota. USDI Bureau of Reclamation. Technical Memorandum No. 8260-99-02. Denver, CO.
- Von Loh, J., D. Cogan, J. Butler, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 2000. USGS-NPS Vegetation Mapping Program, Theodore Roosevelt National Park, North Dakota. USBR Technical Service Center, Technical Memorandum No. 8260-00-04. Denver, CO.
- Vories, K. C. 1974. A vegetation inventory and analysis of the Piceance Basin and adjacent drainages. Unpublished thesis. Western State College of Colorado, Gunnison. 243 pp.
- Wasser, C. H., and K. Hess. 1982. The habitat types of Region II. USDA Forest Service: A synthesis. Final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 140 pp.
- Welsh, S. L., N. D. Atwood, S. Goodrich, and L. C. Higgins, editors. 1987. A Utah flora. *Great Basin Naturalist Memoirs* 9. Provo, UT. 894 pp.
- Williams, C. K., and T. R. Lillybridge. 1983. Forested plant associations of the Okanogan National Forest. USDA Forest Service, Pacific Northwest Region. R6-Ecol-132b-1983. 140 pp.
- Wilson, H.C. 1969. Ecology and successional patterns of wet meadows, Rocky Mountain National Park, Colorado. Unpublished dissertation, University of Utah, Salt Lake City, UT. 99 pp.
- Wilson, R. E. 1970. Succession in stands of *Populus deltoides* along the Missouri River in southeastern South Dakota. *The American Midland Naturalist* 83(2):330-342.
- Youngblood, A. P., and R. L. Mauk. 1985. Coniferous forest habitat types of central and southern Utah. USDA Forest Service, Intermountain Research Station. General Technical Report INT-187. Ogden, UT. 89 pp.
- Youngblood, A. P., and W. F. Mueggler. 1981. Aspen community types on the Bridger-Teton National Forest in western Wyoming. USDA Forest Service. Research Paper INT-272. Intermountain Forest and Range Experiment Station, Ogden, UT. 34 pp.
- Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985a. Riparian community type classification of eastern Idaho-western Wyoming. USDA Forest Service, Intermountain Region. R4-Ecol-85-01. Ogden, UT. 78 pp.
- Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985b. Riparian community type classification of northern Utah and adjacent Idaho. Unpublished report prepared for USDA Forest Service, Intermountain Region, Ogden, UT. 104 pp.